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AN EXPEDITION TO THE BRITISH CAMEROONS: *A paper read at the Evening Meeting of the Society on 26 November 1934, by*

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THE Percy Sladen Zoological Expedition to the British Cameroons 1932–33 was organized with a view to making as complete a survey as possible of the mammalian, reptilian, and frog faunas of a selected district in the "forest area" of West Africa. The basis of the work was the collection of a large series of specimens from the various types of habitat we met with in the area that we had chosen, and also research in the field upon their topographical and local distribution, seasonal variation, and habits.

Personnel

At the outset the personnel consisted of Mr. W. M. Russell and myself, but in February of 1933 Mr. P. H. Seaton joined us. I should explain that Seaton came as a substitute for Russell, who had been invalided home under suspicion of a serious illness, but when the latter arrived at Lagos, further medical examination showed, happily for all of us, that the first diagnosis had been entirely inaccurate, and so he was able to rejoin the expedition. He awaited the arrival of Seaton's boat at Lagos, and the two of them proceeded to Mamfe, where they joined me.

I should like to include under the title of personnel at least the five literate African boys whom we trained as taxidermists, collectors, and scientific assistants. When they came to us their only qualifications were the broad grin of the West African, some desire to work, a certain knowledge of writing, and, to a very limited extent, spelling. By the end of the expedition they were expert taxidermists and collectors, well versed in the use of alcoholometers, hygrometers, and other instruments presenting equally insurmountable difficulties to their untrained minds; but they still retained their spontaneous sense of humour. These boys were responsible for the bulk of the routine work and much of the successful collecting.

To express my thanks adequately to Russell and Seaton is a quite impossible task. For weeks on end they laboured every day from 8 a.m. till midnight at subjects that had not previously been in their line, in the unpleasantly cramped

surroundings that camp life involve, in order to make by office methods a success of a trip which might easily enough have been carried out only in the spirit of a sporting adventure. Russell, having overcome the persistent aroma of decomposing frogs, took charge of the Reptiles and Amphibians, and also of the housekeeping, with a zest and perspicacity that never wavered to the last day, in spite of his commissariat calculations that ran into sheets of foolscap and resulted frequently in our receiving the barest quota of our daily allowance of tinned milk and kindred necessities of life. Seaton, who, from the almost feudal organization of the labour he mustered for the ruthless tracking down of Podogona, became known as "the Duke," included among his other activities the Invertebrates and the photography.

Course of the expedition

We sailed from Liverpool aboard Messrs. Elder Dempster's motor liner *Apapa* on 24 August 1932, arriving at Calabar, S. Nigeria, on September 11, after a voyage spent in completing written preparation for the work. A wait of ten days in Calabar, only made possible by the great hospitality of Mr. N. H. Cleverley, the Station Magistrate, enabled us to get together a skeleton household staff and complete our equipment. This consisted of a year's supply of all scientific gear and household requisites with the exception of groceries and fresh foods, which amounted to just over one hundred loads. I believe it was due to our having at the outset a complete list of all equipment, down to the last drawing-pin, and also to a process of monthly stocktaking, that we never needed to replenish our supplies nor had anything superfluous by the end of the trip. All along, the principle at the root of the organization was the elimination of anything that was not absolutely essential to the work, even at the expense of personal comfort, so that as much time and money as possible might be devoted to a continuous routine of scientific work, and the utmost mobility secured in country far removed even from native villages.

The corner of Africa in which we operated is singularly lacking in modern communications. The delta of the river Niger is thickly populated, covered with a network of roads, and extensively farmed. The Cameroons and territories to the east are separated from this belt by the Cross River, and are different in every respect, being devoid of roads, railways, and towns. Transport is only possible by river during the wet season or, at other times of the year, by porterage on foot. We arrived in Calabar during the rainy season, at a time when the Cross River is navigable by stern-wheel paddle-boats as far inland as Mamfe in the Cameroons. This station is cut off from Nigeria not only by the Cross River, but also by the Oban Range which runs north from Calabar, and it is equally inaccessible from the east if approached from the French Cameroons, because of a tract of highland extending northwards from the Cameroons Mountain itself. The country is clothed in luxuriant vegetation, the vivid green of native farms and secondary growth, and the dark sombre tones of the virgin jungle contrasting vividly with the red soil and pale grey rocks. Little villages of palm-thatched, mud, and wattle houses, nestling among groves of bananas, present a pleasant kaleidoscope of colour and interest. Everywhere there are "small waters" or "great waters," as the rivers are called by the natives. All these feed the Cross River, either directly

or *via* its great tributaries, the Munaia, Bali, Mbu, Mainyu, Mo, Munaia (N.), or Oyi.

The more outlying territories prove fascinating to a traveller appreciative of natural beauty. Mile upon mile of silent forest lies sweltering in the tropical sun, uncharted and untouched even by the natives, with rivers like canals running straight through the forest silent and mysterious, gorges choked with rushing torrents, and great cliffs, moss-covered and rugged, rising above the trees from which immense views of rolling forest can be obtained, toned to a uniform pale blue by the noonday haze.

We reached Mamfe thanks to the lucky coincidence of two launches happening to connect at Ikom, making our journey up the Cross River both easy and quick. We used Mamfe as a base for the first four months, working in the surrounding district and farther afield to the east, south, and west. Russell was taken ill in January, and I accompanied him down river at the end of the month. As I have already mentioned, he returned with Seaton to Mamfe in February, and I arrived there at the same time from a camp in the forest. Within three days of our meeting, we were on our way to Asumbo, where we operated for three months. During the latter part of May we were again in the neighbourhood of Mamfe, and then we moved the whole expedition down river to Obubra. For the last month we were encamped near Nko in the Obubra Divisions, between the Oban Hills and the Cross River.

We sailed for home from Calabar on 18 July 1933, and arrived at Plymouth on August 4. The total duration of the expedition was therefore just on a year with ten months in the field. The health of the members of the expedition while in Africa was, on the whole, exceptionally good, considering that the conditions and medical reputation of the country are perhaps the worst in the world. On this account we may all be excused for having suffered from malaria throughout: Seaton in unexpected and violent bursts, Russell with continual low fever, and myself with the intermittent variety. In addition to this, Seaton had to leave Asumbo for a month, suffering from persistent tropical ulcers. Russell however undoubtedly suffered most, both physically and mentally, during the period when he was under suspicion of grave illness. The African staff were themselves heirs to so many endemic diseases that their occasional fevers and yaws-infected skin wounds counted for little in the long run.

The Mamfe Basin

The area chosen for our scientific investigations was that part of the Cameroons mandated to Great Britain and known as Mamfe Division, in which the natural boundaries, with but one exception, coincide closely with those as politically defined. Mamfe lies within the forest belt, thereby fulfilling the most important condition in our eyes, and the Division is perhaps less spoilt at the present day by the inroads of civilization than any other part of West Africa within this vegetational zone. A third condition—and this is purely zoological—is that it forms the eastern limit of West Africa proper, thus offering good chances of observing the manner in which the fauna of Central Africa is linked with that of the coastal forests. The territory is situated between lat. 5° and 6° 30′ N.; long. 8° 30′ and 10° E., being roughly

triangular with its apex to the north, and has an area of approximately 4160 square miles (equivalent to that of the island of Jamaica). The Division has been known since the beginning of this century, having been penetrated by Conrau in 1899, and later by Ramsay (January 1900 and October 1901), Glauning (1901), and Dr. Mansfeld with several others about the same date. Mamfe Town, then known as Ossedinge, was apparently first reached by Strümpell in 1900. It was first colonized by the Germans from that time, but was mandated to Great Britain at the end of the war, since when little interest seems to have been taken in it. Previously there were large estates, and a considerable colony of white people. Mamfe had terraced gardens, rifle ranges, and a club; Tinto an artificial bathing-pool and bungalows. At the present day there is no commercial activity, the few estates and trading stations have reverted to "bush," and it is all the local District Officer can do to persuade the authorities to assist him in constructing a proper road towards the commercial outlets to the east.

There are only two maps in existence approaching reliability. These are the Nigerian Ordnance Survey 1924 (sheets 11 and 15), which is accurate as to rivers and contours except in the extreme north, and the Karte von Kamerun bearbeitet von M. Moisel 1912 (sheet F.1). The latter is really a quite remarkable example of Teutonic thoroughness and a lasting tribute to its compiler. Every single little village, however small, even to three houses in one case, is clearly marked, and with the exception of a few places of recent origin they are all correct, though the transliteration of their names is a little strange to us. Besides this, countless rivers and streams are shown, all painstakingly assigned high-sounding names. I can however state with absolute certainty that with the exception of some dozen large rivers, not one of these names exists or has ever existed except on Moisel's map. Even such exceptions as Bali, Munaia, and Mainyu are merely local words for "water," "big river," "little river," etc. It is the same with mountains, even if very prominent; thus Nda-Ali means "abode of ancestors." Upon inquiry in Asumbo as to the name of several peaks towering around Tinta Valley, we extracted two names for all of them. It then transpired that both words meant "hill," one of them being literally "large hill" and the other "larger hill." This is perhaps not surprising in a country where the inhabitants recognize only three colours—black, white, and red—but is most misleading if one endeavours to travel by the only maps, for the Ordnance Survey is really no more help, showing as it does 90 place-names, of which 47 do not exist at all, 24 are incorrectly placed, and 15 entirely misspelled. I would like to add that the natives refer to the sky as white, except during storms, when it is black; the Earth is white or red according to depth of colour; vegetation has no colour but is referred to as "trees," or white if the sun shines brightly. Water is always black, which may seem peculiar until it is realized that translucent vessels are unknown. I have compiled a list of place-names of the district, as an appendix, according to the R.G.S. II system of transliteration, giving also old methods of spelling found upon maps. There is however still room for much doubt as to the correct method of pronouncing many of the names, due principally to there being no distinction between long and short vowels, or between the short "um" and the long "oom" ("under" in English and "unter" in German). This point is

Mamfe pool

Fish dam between Bashauo and Nyang

Bridge and road crossing the Bali river

Forest path, Akwa

a very important one in speaking languages such as are found in Mamfe, where there can be a sentence of seven words all spelt exactly the same, but each having an entirely different meaning according to the "lilt" of the speaker's speech.

Mamfe Division is a large basin with a level floor, clothed in forest, and ringed round by grass-covered mountains varying in height from 2000 feet to 5600 feet. The entire drainage of this basin forms the headwaters of the Old Calabar, or, as it is more popularly called, the Cross River. This river flows out of the area by the only gap in the surrounding high land, that is *via* Ikom, between the northern limits of the Oban Hills and the Balegete Plateau. The Cross River is notable for its endless bends and sharp corners, causing the repeated crossing of river traffic from bank to bank, and from this it derives its new name. The Cross River and the Mainyu, as its upper reaches are called, bisect the country from east to west, leaving the southern portion with its fertile basalt plateau to the ravages of native farmers, and preserving the northern for the natural animal population, secure in a blanket of high deciduous forest. To the south, the land rises in tiers through Kumba Division to the Cameroons Mountain (13,200 feet), which can be seen from the open rock slabs above Mamfe station, on a clear day, as if poised among the clouds in the far distance. To the west, the Oban Hills cut across the view like an indigo-coloured wall, while in the east, though too far off to be seen from Mamfe, the country rises to an almost knife-edge ridge of grassland above 3000 feet, which joins the foothills of the Cameroons Mountain in the south to the immense upland plateau of Bamenda in the north-east. To the north and north-west rank upon rank of energetic-looking mountains abut on to the forest country of Mamfe. By referring to any existing maps or, more conclusively, by toiling laboriously up their precipitous faces, it may be seen that these mountains are a westerly extension of the Bamenda Plateau, and that they act as a watershed between the Cross River headwaters and the great Katsena Ala river system of the north. This country, the most fascinating of all, to which I shall refer in more detail later, is known as Asumbo, and culminates in a pile of 5000-foot cones, grass-covered ridges, and miniature plateaux, known as Balegete. The last named of these two districts lies in the northern apex of Ikom Division, South Nigeria.

Nda-Ali, a mountain of 3989 feet, almost ludicrous in its isolation, stands up like a sugar-loaf in the centre of the plain, and, as might be expected from its likeness to the hub of the Chinaman's wheel of life, it holds the fancy of the local inhabitants with the belief that elephants breed on its summit and that it harbours an exceptionally powerful and inhospitable ju-ju. The peculiarity of this ju-ju is its intimacy with the dirty and disagreeable chief of Fineschang alone, which does not seem to detract from the prestige of either although it is totally inexplicable to the other villages nestling around the foot of the mountain. Nda-Ali is very steep, and therefore requires a ju-ju that can be absolutely relied upon to deter even the most energetic from the wish to be guided to its summit by the indolent local inhabitants, who surpass all other Baiangis in torpid insensibility. The men of the village are frankly lazy, but the women are more energetic and have the business instinct well developed. When we announced that two shillings would be paid for each giant frog

Forest path, Akwa

Bridge and road crossing the Bali river

caught in the small streams near the summit of this mountain, they went daily in search of them despite the protestations of their husbands who formed the village council and were the guardians of the ju-ju fable. A refusal to guide us up Nda-Ali at a later date was made the occasion for a somewhat lengthy explanation of this ju-ju's peculiarities, during which palaver it transpired that the presence of women within its domains in no way displeased it, whereas the slightest trespass of mere man would bring the most awful retribution. The machinations of the collective female mind and convenient by-laws promulgated by ephemeral ju-jus are the cause of many insurmountable difficulties and endless palaver in West Africa. The refusal to assist in collecting is prompted by laziness on the part of the men, who foist all work, especially when it may prove laborious, upon the women. If they in turn decline, or a convenient ju-ju taboo can be unearthed, the whole village loses interest in Natural History with singular promptitude.

To describe Mamfe as a corner of the world is certainly permissible when the local inhabitants are taken into consideration. The numerous little forest tribes and sub-groups, with their variety of language and dialect (twenty-five in Mamfe Division alone), are the fragmental edges of—if I may so describe them—three huge rafts of humanity converging one upon another as if borne upon three distinct currents; Bantu-speaking peoples from the south, Tekari and other Aryanized Africans from the north, and true Negroes from the west. The appearance of the Mamfe tribes is negroid for the most part, but Bangwa and Mundane men from the north-eastern area often show strong Arab features, and the Baiangis have two distinct ways of speaking, one for ordinary conversation, which is purely West African in sound, and a harsh, clicking, guttural, arabic variety, which they employ when angry or excited. The Anyangs to the north are a sub-group of the Baiangis, and the Keiakas are closely related. The Baiangis are really a remarkable people, as they possess an amazingly efficient self-contained internal organization, an utter contempt for every other human being alive, and more individual vanity and pride than the worst "beach-boy" in European employ, the type most noted for their harmless cheeky behaviour. Christian missionaries have been among them for twenty years but with no effect upon their deep-rooted beliefs and age-long institutions. The occurrence here and there of European christian names, which have been adopted solely for trade purposes, is the only real effect of missionary influence. The people of the eastern uplands—Fontem, Mundane, etc.—and the Bangwas have been engaged in petty boundary disputes from time immemorial, and will apparently continue to be so engaged until they cease to exist as tribal entities. Tribes to the south-east of Banyang (the country of the Baiangis) are either recent immigrants to the fertile basalt plateau, where they cultivate the rich soil intensively, or are represented by a few small and scattered villages in the less economically prolific parts. The Division contains only two tribes of any interest besides those already mentioned. First, in the north-west corner, the Bokis, who are the most objectionable people with whom I have had the misfortune to come in contact; and secondly the Asumbos, who are, on the contrary, the most charming. The latter, being an off-shoot of the Munchis, still understanding the Obudu Munchi language, and dwelling behind the mountain barrier of the north,

do not properly belong in Mamfe, except within present-day political boundaries. They are the least known, the most interesting, and by far the best people to employ as carriers in the whole district. Regarded in aspects other than purely scientific, the natives of Mamfe Division are most colourful. Despite their wide diversity of blood, they are all quite removed in type from the people we encountered later at Nko, in Nigeria. The Baiangis are indeed reserved, and the Asumbos friendly and timid, but they one and all display the most remarkable humour. After Russell had shot two domestic cows, mistaking them for wild beasts when they entered the kitchen premises by other means than the door, a crowd of owners, chiefs, and others arrived with lanterns to view the damage, apologize for their cows' behaviour, and remove the corpses. After much palaver and inspection of the slaughtered animals, lasting over an hour, a man stepped into our house and said quite solemnly, "I see a dead cow down there." Considering the guffaw of laughter it heralded I feel safe in saying that these people have a keener sense of humour than our own. In fact, their outlook is decidedly of the modern American "wise-crack" order, well shown by the man who offered us a baby Common Bush-cat for 779 shillings, and then had to be carried out of camp because he was laughing so much at our counter offer, which was the sum in pennies, provided that he could carry them away single-handed and in one load.

I know that many will disagree with me, especially after seeing our photographs, but these people are exceedingly handsome. Some of the heads we saw were perfect, whilst the men's figures and the young people's hands greatly surpass the European average. Skin colours from pale coffee to shining blue black occur among these peoples, and every large village has, on an average, one albino, two bright reds, and a weird yellow individual. The white is pure albinoism and does not often survive the ju-ju doctor at birth; the reds are perhaps explained by a throw-back to some ancestral bushman blood, but I can neither explain the yellows nor find any reference to the problem. They are the most beautiful, their pale colouring showing up the lustrous eyes, unbroken curve of lips and jaws, and forming a contrast to the diverse methods of dressing the hair. There is nothing in the face of a good-looking negro to break the continuous flow of lines, nor anything as weak as the European mouth, or as unexpected as the European nose. Their magnificent gait is probably not the effect of carrying loads on the head, so much as of sleeping on hard earth beds, and not wearing clothes. The Asumbos customarily carry loads upon their backs lashed into long wicker-work cradles suspended from the shoulders and tied around the waist.

Mamfe is entirely isolated from the rest of the world except for a postal wireless system, and, in the wet season, the Cross River. A network of forest paths link up the villages which are all very small even for West Africa, and these have been sufficiently improved to bear the one Government lorry and an Austin-Seven for 30 miles to Tale in the east and 16 miles to Faitok or Mpot in the south. The Public Works Department have engineered a fine road for 18 miles between Mamfe and the Mainyu River, due east, where an exceedingly expensive steel bridge, of three spans, abuts on to a solid wall of virgin jungle. We were informed that this was the beginning of an arterial road, to convey merchandise to and from Bamenda, but that lack of funds had curtailed further

construction. Except for pleasure trips in the cool of the evening, we were unable to make use of these roads, as they all led in directions along which our work did not extend, and so our thousand odd miles of trekking had to be accomplished on foot, at the end of a trail of some hundred carriers.

"Porters"—or "carriers" as they are called in West Africa—are excellent, despite the repeated affirmations of European residents to the contrary. We never once had anything stolen, lost, broken, or dropped, although all crockery and glass travelled in open boxes poised on their heads, and one thousand glass tubes and bottles accompanied us everywhere. Much of life in the Cameroons is concerned with "walka-walka," as it is popularly termed by the African, and fun begins when sufficient carriers are at length gathered together. The carriers we employed were of two species, those that had carried for white men before and those that had not. The former had preconceived ideas on the length of a day's trek, which did not coincide with our intentions. Europeans have a most disagreeable habit of leaving at dawn for a march of about 17 miles, on an average, to a previously appointed location where breakfast is served. Our method was to have a leisurely breakfast in pyjamas, whilst our scientific gear was packed, and then to walk as far as we could until tea-time while it was at least warm and sunny. This gave the latter variety of carrier a loop-hole for disappearing miles ahead, as the native covers tremendous distances when by himself, and also caused several commotions in the early morning, as carriers got bored with waiting by 9 o'clock and often retired to the village for a day's siesta. We were also divided over this subject, as walking was torture to Russell, merely a necessity to me, but apparently a great pleasure to Seaton. The result was that our "train" sometimes covered 10 miles of narrow forest paths, with ourselves at the rear, making it incredibly difficult to get a little refreshment on such occasions as the "drink-box" was carried by Eti-yaw, the champion Munchi walker. A little band of twelve Munchis, who remained with us throughout the expedition for collecting as well as carrying, proved our most valuable asset, owing to their almost superhuman powers of endurance. On one occasion they travelled with me alone from Ikom to Mamfe, a five-days' journey, which they accomplished in forty-eight hours. This was on my return journey from accompanying Russell down-river in February. Leaving Akon at 7 a.m. on the second day, they sang all the way, to the accompaniment of an absurd little leather whistle having only two notes, and reached Mamfe at dusk, a distance of 40 miles, where I weighed their loads, the lightest proving to be 92 lb. The temperature had been 89° F. in the shade, and the hygrometer showed saturation-point, while the path was one continuous network of roots, making the most difficult and unpleasant of walking surfaces. They complained bitterly if they were given light loads, and the only punishment that had any effect upon them was to make the ring-leader of the trouble walk without any "cargo" in front, where he was subjected to an unending fire of jests and taunts by the others, with constant allusions to his weakness and his mother's reactions should she see her son thus degraded! We retained these Munchis as collectors, in which role they proved remarkably adept. Coming to know them all by name, I instituted a book in which all they found was entered, so that they could be paid once a month. These men lay on their stomachs for hours on end in the forest,

filling little tubes with spiders and small snails, and fought like tigers over the possession of even the minutest. One Dambaike had such a keen eye and such fine fingers that he produced on one occasion nearly a hundred of the precious Podogona alive (they are about 6 mm. in length). They also acted as body-guard, in which capacity they formed a ring round the house to keep away inquisitive village folk and unwanted humorists. Their treatment of these was good-natured and decidedly tolerant considering the exasperating way in which they themselves were handled at times. On one occasion I instructed them to dig up a plot of ground some distance from camp, in order to capture subterranean snakes. During these operations I was hurriedly called back to camp and forgot them. Late that afternoon I was deeply engrossed in some papers when a strange noise approached the camp, and shortly after, these Munchis appeared round a corner of the bush, working industriously. They had literally dug their way home. I later inspected their track, and found a belt some 20 yards wide and close on a quarter of a mile long entirely denuded of turf and trees to a depth of about 2 feet.

The floor of the Mamfe Basin has the surface of a well-ploughed field, making distances on foot just half as long again as shown on the map. From any real hill however the treetops again appear dead level. Owing to this pent-roof topography, the torrential rains disappear while they are actually falling down multitudinous little gullies to the streams which always follow the troughs between the little ridges, and which in turn eventually find their way into the great rivers. As a consequence of this, the rivers sometimes rise 20 feet in a few minutes, resulting in some of your carriers getting across dry, while the latter half of the column may be unable to follow them even by swimming.

We visited many villages in this forest country, some of which stand out in my memory by reason of particular incidents which occurred. At Bashauo, when on the way to Asumbo, Seaton suddenly went down with a very severe attack of fever. We had over a hundred carriers, but no proper cook, and intended moving on to Asumbo the next day. No sooner had we settled down to await his recovery than a positive bombardment of rare specimens began. Natives poured in all day long with frogs and bats in tens and twenties at a time, and we began to run short of spirit for preservation. Then Russell got fever as well, and our supply of pennies came to an end, a most serious matter when buying small animals. Work had to continue until the early hours of the morning to overcome the difficulties of putrefaction, and batches of carriers continued to demand to be paid off. The supply of small cash upon expeditions is a matter normally neglected by travel writers and even, I am told, by travellers in the field, on some occasions. In our case it presented an almost insurmountable obstacle. For days or even weeks before we moved our quarters, messengers had to be sent to native courts, traders, chiefs, and similar influential institutions sometimes at considerable distances, to beg for pennies or shillings. Both are essential, as even natives used to European enterprise refer to paper notes as "books" and refuse to accept them, believing them to have no more intrinsic value than an I.O.U. from a white man; which, unfortunately for our prestige, is not always quite as reliable as is popularly supposed. Carriers are paid in pennies, occasionally in shillings, food is

bought with pennies and all our specimens were purchased at rates varying by pence or fractions of pence.

One evening, at the very height of disorganization, I decided to take a short stroll by way of relaxation. Stepping out of the house however I could hardly believe my eyes, for the whole ground seemed to be moving towards me, making an eerie rustling sound. An endless drove of ants was advancing directly upon the rest-house, containing Seaton's now enfeebled frame. These ants have been known to sweep whole villages clean, including some of their inhabitants, whose eyes they attack first, partially paralysing them with their countless tiny injections of formic acid and eventually picking their skeletons clean. Our army of boys fell out of the house in response to my shouts, and filling their mouths with kerosene, squirted the vanguard before throwing down lighted matches, and then building a low wall of burning grass at a tangent to the house. At first this did not check them, their myriad little bodies piling up and choking the fire to a depth of over 6 inches, but eventually the whole drove veered off to the right and disappeared into the bush. Two hours after dark they were still passing unabated, and I am sure it was some hours before the "watch," left to observe their tactics, fell asleep.

This was not our only trouble at Bashauo. No sooner had the ants been diverted and the "cow-palaver" settled than a high-powered tornado sprang upon us out of a clear blue sky. Everything went out into the night, including the lights. Solid water swept through the house and a large cage disappeared into the neighbouring bush, along with the terrified baby chimpanzee housed therein, whose screams of fear added to the general uproar. When the wind had abated somewhat, I yelled for the boys, but none came, though there was a continuous babel from the back of the house. Running out, my mind filled with unprintable invective, I flashed a torch upon the tent that we had pitched to accommodate the surplus staff and their skinning tables. What was my surprise to see only an immaculately swept and garnished plot of earth. Peering around in the torrential rain, I eventually located a heaving green mass farther down the slope, wedged into the matted shrubbery some 3 feet from the ground. From it arose a muffled sound, like a tormented soul, and occasionally a leg or a part of a tent pole. When I eventually extricated the head skinner, all he could say was "Master, de light went out."

At Mukonyong we had a little private revolution. Our Munchi carriers were attacked by some other strangers in the town, and the genuine inhabitants joined in with matchets, and heavy earthenware water-pots. So noisy did it become, that we had to intervene ourselves, and extricate two of our Munchis with heads split open. One, by name Cissi, had a 5-inch gash on his scalp which penetrated the skull cap and showed some unpleasant white substance below which palpitated. We dressed this as best we could, removing bits of palm thatching and water-pot with weak permanganate and covering it up with a dressing. He seemed a bit unsteady on his legs and complained of some loss of sight, but after some brandy and aspirins, he retired to feed. Next day he walked 15 miles leading a goat, and within two weeks his wound seemed to have healed. When it is realized that this man was prey to more than one disease which would render any of us permanently incapable, the rapid recovery will appear exceptional. The complete absence in the African of

those mental symptoms which invariably accompany our maladies perhaps explains their remarkable physical tolerance and recuperative powers.

A great deal of the scientific investigation was carried out in heavily forested country from camps to which we have given numbers on the map in the absence of any neighbouring village or local native name for their positions. Lines half a mile in length with traps at 8-foot intervals were thrown out in every direction, and were only removed when the "trapping-graph" was completed. This is a curve varying in extent, but always similar in form. In the grass country, this curve starts at its maximum, and falls gradually until it reaches a point where it shows that only six per cent. of the traps are "taking," after which it remains constant over a considerable period. In the forest country however it invariably starts with a zero reading and rises to the maximum number of animals caught on the third or fourth night, after which it falls away to between five per cent. to three per cent. in about twelve days. Some trap lines remain entirely negative, for reasons that are obscure, but which are perhaps related to excessive humidity, in territory that does not otherwise support a fauna adapted to such conditions. All trapping in the forest is rendered both difficult and meagre in results by the abundance of natural food: an almost uninterrupted layer of fallen fruits which covers the entire ground. In the high deciduous forest the profusion of tree species is overwhelming, and the fruits and berries from these, ripening at every different period of the year, show an unending variety of form, colour, taste, and size. Russell and I used to vie with each other in bringing into camp every evening the most remarkable new specimen we had come across during the day's work in the bush. It was hard to believe that some of them were not artificial, they were so brightly coloured and fantastically shaped. These fruits form the staple diet of an immense rat population, and are so highly scented, in many cases, that even coconut holds little attraction as bait for animals.

There were three other methods of obtaining mammals which we constantly employed in the forest. First, shooting at night, for nocturnal types such as dog-tailed Lemurs, Flying Squirrels, and the Potto, in which case we made use of the method known as "jacking," that is to say, shooting with the aid of powerful torches in order to illuminate the animal's eyes which we would not otherwise have seen. Secondly, the native hunter and the two head "skinners" would go at daybreak to the feeding grounds of duiker, mongoose, and squirrels. As a result of their activities we obtained a large series of these types. Thirdly, organized search for hollow trees was made every other day during the ordinary routine of turning over huge logs under which invertebrates were to be found. These hollow trees were carefully marked and reported to me in the evening by each of the native collectors when he returned to camp. Next day, armed with bales of dry grass or leaves, axes, guns, and tins of kerosene, the whole camp set out to fire those trees that seemed to me, at any rate, to be the most promising. In each case an area had to be cleared all around in order to obtain an uninterrupted view of the head foliage. Everybody had his job. Two fire-lighters enlarged the hole at the base of the tree to gain adequate access to its hollow interior and then built a bonfire within composed of a bedding of dry sticks, a central layer of highly inflammable material, and a roofing of green leaves which produced volumes of smoke when lighted;

everybody else felled the surrounding trees and cleared away the bush. When all was ready, kerosene was poured into the base of the tree and a match applied; then each of us, holding a gun, stood as far back as possible in company with a boy who acted as loader and an accessory pair of eyes to watch for animals leaving the fated tree. The remainder of our little army was posted around at regular intervals to pick up those specimens that fell by gun-fire or dazed by the smoke. By this method very many of our best specimens were obtained, mostly of species that were otherwise not seen, like *idiurus* (the Pygmy flying squirrel), arboreal dormice, certain squirrels, and several bats. If animals were forthcoming the boy who had found and marked the tree received a "dash" in money proportionate to the value of the specimens obtained.

The number of frogs that may be found even in the driest parts of the forest, if diligent search be made, would astound most people. Hundreds of acres of dry leaves were raked over during our stay, beneath which as many as eighty specimens were on one occasion taken in a single night. The metallic *cloques* and rattling musical burblings of tree-frogs resonate among the topmost foliage of the giant trees throughout the night; they must live there in millions. Frogs are, in fact, to be found in almost every conceivable habitat ranging from puddles upon main roads to the water-pitchers of giant flowers. Noticing that many rare and interesting species, otherwise never seen, were attracted to the lights of the camp, we developed a method for obtaining these types in greater numbers. A white sheet was hoisted perpendicularly among the foliage of the forest trees, and being illuminated by a strong light, attracted countless nocturnal insects. Periodically small groups of tree-frogs, or more seldom single individuals, would suddenly appear, adhering to the white surface as if by magic. Hurriedly swallowing a few insects near to hand, they would often as mysteriously vanish again before our unwieldy hand-nets could close in on them. As however our technique approached perfection, many proved either too greedy or insufficiently agile.

There are fourteen constant species of rats in the forest, replaced in farmland and secondary jungle by eighteen other species of quite different genera. How these latter got there or why they are unsuccessful in virgin jungle is a problem of great interest and one which defeats almost all speculation. Upon the scattered patches of true grass, occasionally met with in the Mamfe basin, there are but two indigenous rat species, but in Asumbo at least twenty-one species are met with in this habitat, which is far more extensive in that area. There are five species of lemur in the forest—Elegantulus, two species of Galago, Periodicticus, and Arctocebus—all common, though, strangely enough, also plentiful in secondary growth. The flying squirrels (Anomalurus) are by no means rare; in fact, nearly every hollow tree in the foothill country at Bashauo housed a couple. There were two brilliantly coloured varieties of Anomalurus Beecrofti, one of a vivid green and orange which was apparently diurnal. In the early morning squirrels were everywhere. The large Heliosciurus, which inhabits the topmost branches of the highest trees, makes a terrific booming noise like a huge gong, which never fails to excite every Hornbill, Plantain-eater, and other bird in the neighbourhood, and is consequently a signal for the most appalling uproar.

1. Found among the Baiangi and other tribes

2. Common among the Anyang

3. Another form of Anyang hair-dressing

4. Akunakuna tribe at Ediba on the Cross River

5. Obubra

6. Among the Asumbo

Evolution of hair-dressing styles in Mamfe Division

Boy with cross-bow

Hunter, gun, and chimpanzee

Genets (Genetta) and False Palm Civets (Nandinia) were also exceedingly common, and these, together with Mongoose of three species, Leopard, and the very rare *Profelis Aurata*, complete the list of forest carnivores. Duiker were plentiful, as were the larger Ungulates such as Buffalo, Buck, Hippopotamus, and Elephant, which were well known to the natives and white residents with sporting inclinations, though not sought after by ourselves. Other groups were well represented; Chimpanzees and Monkeys, countless Bats, Shrews, and that absurd creature the Pangolin or Scaly Ant-eater, called by the Hausas "The Modest One," because it rolls itself up when approached. In the deep gorge of the Mainyu River, a deeply incised meander leading into the pool at Mamfe, I came upon a series of extensive passage-like caves, caused by the shifting of gigantic rectangular blocks of the country-rock, in which two species of bats and an obscure spider-like creature were breeding in great profusion amid stifling conditions. The larger of the bats, Hypsignathus monstrosus (the Hammer-headed Bat) is, I should say, quite the most grotesque of all mammals, with a sleek head like a horse, baleful greenish eyes, and ears like a cow.

Nearly all these animals were used by us as food, as were also white ants fried on buttered toast and Monitor Lizards in curries. This diet, combined with fresh native vegetables gathered in the bush, probably accounted for our good health.

The Mountains of Asumbo

Leaving Bashauo in its arena of softly tinted heliotrope hills, the path rises steadily to Atolo (2500 feet), beyond which village commences an almost perpendicular ascent by a natural stairway formed of huge rounded boulders piled one above the other. The lip of the Mamfe basin, which at this point is 4500 feet above sea-level, is reached in about two hours. Here the vegetation shows some change though still remaining dense forest; but the descent which commences immediately brings one within a few hundred yards to a most abrupt and surprising change. Stepping—or rather sliding—out of the damp forest, one is confronted by an immense panorama of steeply sloping grass-covered mountains, their ravines upholstered with dark green shrubbery, backed by other more distant ranges and glimpses of a level plain far below, stretching away to the horizon like an azure sea. The almost perpendicular slippery clay-covered slide, which here takes the place of a path, descends to Tinta, lying at an altitude of 3500 feet above sea-level. The total distance between Atolo and Tinta as the crow flies is shown to be just under 4 miles on the map, but even with the best carriers, a good five to six hours must be allowed to accomplish it on foot. The change from low forest country to Asumbo is as complete as that from London to the heart of the English countryside and calls forth much the same sensations. The forest is enclosed and querulous like an immense roofed-in city, the grass-covered hills of Asumbo are sunny and open, filled with fresh air and a restful solitude. Little bell-like drums echo from the plantain farms high up the hillsides, and clear brooks babble down rocky gulleys filled with gently waving grass and flowers. The breadth of vision and the soft breezes are most unexpected.

Tinta, traditional and modern administrative centre of Asumbo and

Messaga, is the Mecca of the negrophilist. There has never been a resident white man, and little visitation even by the Mamfe Administrative Officers. The natives are quite natural and uncivilized, and retain all the courtesy and fine humour of the true savage. Chief Ekumaw holds a tangible sway over the four main tribes—Ovando, Okush, Echebbe, and Message—as may be verified from one short visit to the native court of which he is president and where he enforces the strictest rules of censure and debate, in every way more orderly than our present-day House of Commons! That the sub-chiefs are all born orators is obvious from their systematic presentation of argument without interruption, their impressive gesturing, and their absolute abidance by Ekumaw's summing up. Also in the display of traditional ju-ju dances, arranged for us by Ekumaw, organizing ability was clearly displayed, but was, I must admit, in our eyes, quite eclipsed by the spectacle of seven picked men and fifty women dancing to an orchestra composed solely of fourteen drums. Europeans believe they understand what the word "dancing" means, and certain American Negro orchestras have recently given us some idea of the developments of which rhythm is capable, but the show that we witnessed for four hours in Asumbo put the whole thing on a plane so much more advanced as to be almost incomprehensible. During this dance a ju-ju figure was demonstrated to us. This is an expert dancer, clad in a finely woven grass-rope costume, in shape somewhat reminiscent of that of the Ku-Klux-Klan, and surmounted by an immense wooden head-dress, finely carved to represent a rider on horseback, with huge eyes and what appeared to be Arab draperies. The costume is of great age, having been handed down from generation to generation and purporting to be the handiwork of the "first" generation, which was the immediate offspring of the founder of the tribe, calculated to be some four hundred years ago, though this estimate is open to criticism. The dancer held two 5-foot spears, as thin as a reed, upright in his hands, and was preceded by two men carrying between them a long sausage-shaped bag, ornamented with two bells and some bright red feathers woven into a rough rope. This is to rid the ground of indolent spirits that may be resting about the place, unseen but malignant. The ju-ju's dance consists of short bursts of violent stamping with the legs wide apart (the motion of "treading water"), but performed with such incredible velocity that the feet are hardly visible and only a rolling noise like an immense drum is heard, the body being erect and otherwise motionless. The dance that followed was accompanied by the firing of dane-guns. Each sub-tribe demonstrated its particular rhythm and drumming, with picked women who formed a circle. Their bodies were highly oiled, causing them to stand out like robots against a vivid yellow evening sky, and their movement was an unforgettable sight, muscle, limbs, and even individual muscles moving together in perfect unison.

On another occasion a dance was given to celebrate the anniversary of the death of Ekumaw's brother. The beauty of this, performed in brilliant sunlight, was in great contrast to the ju-ju performance. A mass of dancers, holding sprays of vivid green leaves above their heads, advanced and retreated against a background of red earth and walls, swaying in rhythm and singing a chant which defies notation but remains for ever in one's mind. Many tribes in West Africa undoubtedly have music of a still further advanced construc-

tion; exceedingly complicated dances are also met with very frequently, but all the better known among these have been influenced greatly by European ingression from the coast or Arab and Muhammadan ritual from the north. It is said that the African had not even invented a wheel before the coming of the Europeans, and it is quite certain that he had failed to discover any other simple mechanical device such as forms the basis of our practical civilization. Many Europeans also assert that any traces of musical expression found in the lands of the Negro are primitive and quite undeveloped. I would however like to state with conviction, though admittedly with insufficient technical proof, that the Negro, through the medium of simple percussion instruments, has evolved along his own lines just as far as if not farther than we have with all our complexity of harmony and varied orchestration. No white man can understand, and very few appreciate, such negro music; our ears are not trained to the minute variations of tone and frequency that they employ. To reproduce an African band of twenty instruments it requires not only twenty drums, but also twenty Africans to play them.

The Asumbos among their mountain fastnesses are secluded from even the current life of West Africa, which probably accounts for the survival among them of many unique customs of undoubtedly ancient origin. The information gleaned from the courtesy calls of Chief Ekumaw, during which we obtained much historical anecdote, was augmented by the native court clerk, who spoke some English and had a devotion to his tribal land far surpassing mere patriotism. They have kept careful verbal record of their ancestry, from which it appears that the founder of their tribe, one Akem, moved up from the Obudu valley when young and obtained his wife by purchase from a far country, probably ancestral Munchi territory towards the Benue. He gave rise to a race of fighters who populated the hill country and infringed upon the Anyangs and other forest people. Tribal wars were incessant and are not yet over. They were mostly for possession of ground where crops grew better and sticks were obtainable for housing and fencing, for the land is so poor in Asumbo that at certain times of the year the inhabitants strap themselves in with broad belts to counteract the pangs of partial famine.

Belief in an all-pervading supernatural power is traditional and real, being very much the same in conception as that held by the Buddhists and present-day thinking people in Christendom. Its origin is undoubtedly Negro-African and not Islamic, being arrived at impersonally and surrounded by a typical host of animistic sub-godheads. As explained to us by Ekumaw himself, it appears to be most closely paralleled by the ancient Egyptian Amen-ra, being the only true autonomous power beyond the confines of this life, but remaining unconcerned with the activities of the world after its creation together with all that is in it, including the multitudinous souls, spirits, ju-jus, and sub-gods. Ekumaw received his first cigarette from us, and declared its aroma to have transported him in mind to the regions of those that know about the great God. The novelty of this vile contraband Japanese product undoubtedly had the same effect upon his untutored but powerful and sensitive mind as incense in the Roman temples had upon the early Christians. Here, as elsewhere in Negro-Africa, the spirit world is as vivid as the material, but many customs and practices seem to have a decidedly practical origin. This

forms a lesser religion of paramount importance even in these days, and mostly centres round a sacred lake among the southern mountains of their country. To it an erring wife who had transgressed towards our carriers' quarters had to make a pilgrimage bearing a fowl, whose blood had to be committed to its waters before her rightful husband's ire was appeased. To it also we dispatched three "blessed" eggs and a small mirror, by way of showing our good intentions and friendliness to the tribe in general.

There are ceremonies innumerable in Asumbo. A woman who has given birth to a child is painted brick red, probably not an unwise thing in a country where skin evaporation is so rapid, and the production of milk for a healthy child not an easy matter. Circumcision takes place at about the age of twenty-seven, and marks a period in a man's life which is celebrated by the discarding of all clothes and the adoption of seventy necklaces of varying hues in their stead.

We were assured by the oldest inhabitant, a most active old gentleman with a raucous laugh, that the country has altered but little since the coming of the white man. Cloth is the most outstanding innovation and one which at first scared them very much. Previously only monkey skin sporrans and strips of native Obudu material were worn. The latter has the appearance of dirty bath towelling stained with dark red ink. The women still wear only a little belt below the stomach and over the hips supporting a narrow strip of such material or skin which is whisked from side to side like a tail when they walk.

The Germans first came to Tinta as a result of a palaver over the sale of bananas to their troops at Bashauo. Ekumaw managed to gain their friendship, but was unable to restrain the people of neighbouring Ntamele, who killed a German officer and most of his men. This brought dire retribution with a wholesale massacre, from which the people of Tinta were only rescued by the intercession of Ekumaw. The Germans then planted a small trading station at Tinta and left. Nothing was done by the British until 1925, when the laws affecting debtors were altered and a native court planned for the district. Odi, the son of a noted Gorilla hunter of Ntene, has risen to the distinction of court interpreter at the district office. His version of the introduction of European law is illuminating. In old days a debtor unable to meet his obligations was sold to the other party and the money paid to the chiefs in session as settlement. Now he must pay or go to prison. Consequently, he hands over his wives, and his land falls out of cultivation, for they are his labourers. Owing to the prevalent custom of borrowing, and the certainty of remuneration from successful litigation—in itself a delight to the African mind—more and more land is falling out of cultivation. Added to this, the falling price of their only marketable product, *i.e.* palm-kernels, and the fact that livestock is not saleable, make it increasingly difficult for them to raise the yearly tax of 3*s.* 6*d.* per head.

The most outstanding things in Asumbo are the sunsets, which appear so unreal that confirmation must be sought in my diary, from which I quote the following entries:

> *April* 11. Entire valley filled with two strata of billowing clouds burnished copper on their western faces, vivid purple on their eastern. Hills appeared bottle green and rock faces salmon-pink.

April 16. Heavily overcast except for sudden line of clear duck's-egg blue sky over the northern plains. Clouds deep indigo turning black where dense, with royal blue prominences and powder-blue lower layers. Overhead clouds grey and slate-blue with snowy white background.

April 17. Entire sky clear but whole landscape and even the interior of the house filled with intense electric blue as if from mercury light. As night came on the whole S.–W.–N. sector became a glowing heliotrope with the appearance of great depth.

I have seen evening skies in Asumbo look like Italian ceilings, like canvases of Turner, and like modern interior house decorations; but I never saw two in any way similar. What is the explanation of these phenomena? Perhaps the altitude and the intense electrical disturbances of daily occurrence from dusk to sunrise. Some reasons may be forthcoming if the lay-out of the land surface be more carefully scrutinized on the map. Tinta lies at the head of a large valley facing due north. This valley is one of a number of vast corrugations having a north–south trend and falling down to the Katsena plains, extending from Bamenda in the east, through Manta and Asumbo, to Balegete in the west. Two prevailing winds meet over the lip of the southern end of these valleys and the results may be experienced at Tinta almost any evening. One air current rises from the Mamfe basin and is hot and very wet; the other spreads from the northern plains and is hot and dry. The southern clouds usually creep in beneath those from the north, though not always, for both have to rise considerably when they encounter the mountains in which Tinta is buried. If it has been a hot day in the Tinta valley the cloud banks from the south are rolled back when they reach the lip of the watershed, but if the land surface is cool they pour over like treacle filling the valley and slowly revolving gather density. Those from the north do likewise, though more slowly and usually at a higher level. It used to amuse us greatly to watch the way in which the two opposing forces carefully avoided each other until the first blinding flash of lightning which heralded a general mêlée with columns of cloud rushing suddenly up into the upper atmosphere, dense blankets careering madly down mountain slopes, and little puffs apparently lost and stationary poised between our tents and the village. Whatever the cause or the procedure, the result is invariably the same—ice-cold rain and dense mists.

We were privileged to be the first people to walk, or rather climb, about on the tops of these mountains, and some of the views we witnessed were quite overwhelming in their expanse. This portion of West Africa from a height looks very old; there are no aggressive Alps or stretches of rolling hilly country, but instead seemingly interminable plains with here and there great piles of subdued and isolated high country. Such was the view from the summit of a peak behind Tinta which we called for the purposes of identification "The Dome" (5600 feet). Plains like an ocean rolled away in every direction except to the east whither the uplands upon which we stood extended range upon range as far as the eye could see. Far to the south-east arose the Cameroons–Kumba elevation; to the south the Oban Hills; to the north-west the Adamawa Plateau; and to the north another isolated island of softly curving peaks huddled together on a tableland which we have not been able to identify with any certainty. From Obubra, where we later encamped, we identified the

Dome with the aid of powerful field-glasses on an exceptionally clear day. It, in turn, looked like the summit of an immense island upon the horizon.

Between the grasslands of Asumbo and the forests of the Mamfe basin there lies a narrow belt of true mountain shrub running from east to west like a rampart along the lip of the watershed. It was to this vegetational zone that we were led on the morning of our first day in Tinta. Late in the evening, on the day of our arrival, Chief Ekumaw and a hunter of note, one Afa by name, presented themselves in a somewhat florid condition and announced that a man had been attacked by a big black animal in the hills, which "be so-so man but no be man, be more like so-so monkey but he big too much." After their initial excitement they went on to explain that the man had fired and wounded his aggressor as he retired into the jungle beating his chest and making a noise "very terrible to behold." There then followed a practical demonstration. Next morning before daybreak we set out with cameras and guns and were led by Afa, at a steady $4^{1}/_{2}$ miles per hour, up almost perpendicular faces, through the clouds, to a point that showed 4800 feet on the aneroid. Wriggling on our stomachs, soaked in icy-cold perspiration, beneath matted creepers and sodden moss, we struggled upwards seemingly for ever, trying to keep the hunter's heels in sight, and eventually came quite unexpectedly upon a most puzzling object, having the appearance of a gigantic puff-ball. As Russell remarked, if anything less than the magnificent male Gorilla, which it proved to be, had been at the end of this forced march, it would have been a very bad day for our guide. It required the assistance of all sixteen Munchi carriers and many townsfolk to carry this grand old man's remains down to the town, where there was great rejoicing and palaver. By sundown we had the skin severed from the huge corpse, and the meat was then cleaned from the skeleton. For his particular portion Chief Ekumaw claimed a rump steak and the whole of the small intestine, which apparently has great ju-ju value. Everybody ate the meat, which formed a waist-high pile. While I dissected the animal, the hunter who had shot and killed the beast stood over me with a terrifying expression and an immense knife. As soon as I gave the word he fell among the entrails like a wild animal, hacking right and left. The collection he made consisted of a small portion of eyelids, armpits, groins, lungs, gut, stomach muscles, and the whole heart and pancreas, showing an amazing knowledge of anatomy. These were all boiled down together with a fowl, half eaten by the hunter, and the rest smeared over the sights of his gun to ensure future kills. The skin took nine men until the next morning to clean and prepare, as putrefaction had set in. Gorilla are common in this country, though I sincerely hope that no big-game hunters or professional collectors will believe this statement. Families roam back and forth in this mist-enshrouded land of dense shrubbery and bare rocky tracts, sometimes descending on the natives' plantain fields which are pushed far up among the hills. Hunters told us how family likenesses among individuals enable them to recognize particular Gorillas and report their movements. Associated with the Gorilla are Hyraxes and Baboons and a large Buck which we were unable to obtain; otherwise this country is very barren of mammals. Rats are not plentiful, and only a few bats with occasionally a leopard or a Mangabey monkey are met with.

Bashauo rest house

Forest camp on the banks of the Bali

The mountains of Asumbo

Chief Ekumaw and wife

The rest of Asumbo is grassland with dense shrubbery bordering the torrential mountain streams and in the extreme north true orchard bush. We camped for some time at the junction of the grass and a patch of shrub, while procuring the rare Potamogale (or Giant Water Shrew), which was one of our main objects in visiting Asumbo. These had to be sought at night with flares, while wading up the beds of crystal-clear streams in which they lead an aquatic existence, swimming like a fish. The other animals encountered were most surprising and varied. Twenty-one species of rats, some of them types that should live among the branches of high forest trees, others typical of the true northern fauna, monkeys of little-known species, and fruit-bats of every size and colour were of daily occurrence. Frogs with hairs, with claws, and with eyebrows, frogs that whistled when dug out of holes, and others that ticked like clocks; small ones with black spots that turned to silver when one breathed on them, and large ones with elevated stripes that disappeared under similar treatment. Every day a different snake was met with either in the grass, the river, or the tent, others were dug up when removing turf by the acre, in search of subterranean spiders and Coecilians. The latter are limbless Amphibia, and we were lucky enough to strike upon one of their breeding grounds by digging, so that eggs at all stages and valuable data upon the life-history of a new species were obtained for the first time. The climax came when Russell was attacked by a bat of quite startling dimensions, and I dug up a spider that when fully spread out filled one of the collecting dishes of 8 by 12 inches.

Our camp in this location was arranged so that a covered portion could be constructed between the two tents under which the skinners could work, despite the torrential rains that now fell almost daily. Otherwise the place had the appearance of a small private zoo, there being cages all round filled with livestock that would thrill the most hardened zoologist. It was not far enough from Tinta to discourage hunters from bringing out their animals, and an almost constant stream arrived. Afa was among them, though he had to resort to collecting small snails, as he was suffering from Filaria. One day he arrived complaining of "breeze for side of eye," which upon examination proved to be a blister-like swelling on the cornea of his left eye. He waited at the camp until the little thread-like worm began to appear, and then submitted to the operation unflinchingly, despite the crude implements that were used. The eye had to be slit with a specially sharpened and sterilized skinning-scalpel, the worm seized with the finest pair of entomological forceps in our possession, and coaxed out with match sticks dipped in melted rubber. I may add that the usual weak permanganate solution was applied and an eye-shade constructed of gauze and sticking plaster. All our fears as to the success of the operation were subsequently allayed by a decided improvement in Afa's marksmanship. It was Afa also who demonstrated to us the use of luminous fungi and centipedes in night hunting. Both these natural objects give off a strong greenish light and the hunters place them in their hair where they become entangled and act as a beacon to the men in following their leader through the bush. Afa also climbed trees and examined spore by their light.

Asumbo is a land that could occupy two active zoologists for twenty years, unravelling the connections between the three distinct faunas which have

apparently been thrown together there by the rapid raising of the land surface into a mountain range. By latitude, Asumbo should be forest, and that it has once been so clothed is, I think, clearly demonstrated by the purely forest forms that are struggling for an existence upon its grasslands. The true northern fauna has encroached because of this grass; and intermingled with these there are traces of a distinct group of mammals only identified with the elevated portions of tropical Africa.

Nko, Obubra, and the Lower Cross River

The last month of the expedition was spent in the Obubra Division of Southern Nigeria, at Nko and Ekuri Beach. The work there nevertheless had an important bearing on the previous survey of the adjacent Cameroons territory. The great south Nigerian plains extend from the western base of the Oban Hills far away towards the Atlantic, and are bisected from north to south by great rivers like the Niger. The last of these rivers is however the lower reaches of the Cross, and it was necessary to ascertain whether this constituted the eastern boundary of the true West African fauna, dividing it from the unique groupings found in the Mamfe area. The Cross River in its sweeping curve towards the sea actually flows north after leaving the bottle-neck exit to the Mamfe basin, and just skirts the southern limits of the northern fauna and vegetation at Obubra before turning due south to the sea. It thus completely isolates the forests to the south-east, including Mamfe (see Map). Nko was chosen as being sufficiently far north to show whether any infiltration of forest forms—from east to west or *vice versa*—by way of the more or less open country round the northernmost corner of the Cross River at Obubra, was possible. A most unexpected discovery was however made when it was shown that the Cross River does not even form a partial barrier to the fauna of the West, but that the Oban Hills do so in a most decisive manner. Not one species found in Mamfe, with the exception of universally distributed animals like *Atherura africana* (the Brush-tailed Porcupine), was present in this district.

The level country bordering the lower reaches of the Cross River is intensely cultivated, and supports a human population far greater than anything met with in the Cameroons. Nko was described to us by the resident A.D.O. at Obubra, as "a little bush village," but upon our arrival a portion of its populace successfully covered an open space, twice the size of a large football field, so densely that our carriers had great difficulty in forcing their way through. These people are almost less civilized than outlying tribes in Mamfe Division, very few speaking even pidgin English, and still fewer wearing clothes. They used to be very wealthy on account of the high price of Palm-oil and the hundreds of slaves which they retained, and still do retain, despite the most energetic activity on the part of the British Government and the repeated assurances by the Chiefs that all labour is now paid for. When the villagers were gathered together for a dance or some other function, we always wondered at the clear division among them into large groups, some clothed in the native fashion, a small body of youths in scrappy European garb, and a large separate block of entirely unclothed humanity, until the Head Chief took us into his confidence and explained that the latter were the

slave class. Negroes have been the slaves of all ages; a chapter of our own history books is concerned with their supposed emancipation. To the average person the matter is now closed, only being thought of as an ancient barbarian custom, whereas it is still prevalent, though more politely named, both in primitive countries and in certain highly civilized states. Some West African Negroes are traditionally adept at slaving, and are particularly averse to any legislation against this ancient custom. Much of their law is based upon the value of the human being.

Virgin jungle has altogether disappeared from a broad belt following the river, the farms of adjacent villages meeting in every direction, with the result that the few remaining trees swarm with Lemurs and other arboreal mammals. Flying Squirrels were shot on palm trees in the Chief's compound, and some species of squirrel have taken to living in the thatch of native huts. But for all the activity of man, the indigenous animal fauna seems to be on the increase, if anything, probably owing to the bulk of cultivated food plants.

The staple industry was formerly Palm-oil, for which the native once received as much as 12*s.* per can. The present value of 6*d.* for the same amount probably accounts for a remarkable experience which we had. One morning the Head Chief, who was a man of considerable character and authority, presented himself in company with fourteen sub-chiefs and a cloud of retainers all especially clad in their best "cloths" and ivory bracelets. After they had seated themselves solidly, and complete silence had been established—itself a great rarity in Africa—they humbly asked, through the interpreter, for an explanation of the "financial crisis." The question was so unexpected in the heart of the African jungle that we were quite taken aback. I endeavoured to offer some adequate reason however, depicting the effects of the world war of which most of them had heard, and I believe, in some measure at least, managed to dispel their belief that all white men manufactured money to meet their individual needs. To explain further that the absence of money among the Africans was not due to a greatly decreased supply being coined by the Whites appeared to be quite unbelievable to them, and the necessary arguments that followed had such a strongly soporific effect upon the older members of the council that I resorted to playing stentorian jazz records on the gramophone. As none of those present had either seen or heard such a machine before, the debate ended in a complete triumph for us, although I was personally censured by the oldest Chief for being so wicked as to keep a lot of men in "the little black box" where they must play and sing for me.

It was here that one of our tables began to grow. This at first sounds incomprehensible, or at the most, a true traveller's yarn. The table in question was formed of trestles set in the hard mud floor and surmounted by a large board, held in place with string. On it stood jars of spirit until the fateful morning when luxuriant green vegetation sprang from one of the upright legs. This is not at all uncommon in this country, which may account for, though not prove the authenticity of, the tale often told about the man who left a European bedstead in a native rest-house, while away on a long trek, and on returning found a healthy oak sapling bowing its head to the only window. It is however true enough that telegraph poles grow so fast that the wires are rapidly carried out of reach among the upper foliage of the forest, and the handle of an axe

that we left at one of our camps took root and grew into a flourishing little bush in five months.

Very extensive collections were made at Nko owing to the greater efficiency of our organization, a dozen extra carriers as collectors, and the comparative simplicity of trapping in farmed land and shooting in little isolated patches of virgin jungle. At Ekuri Beach this almost violent activity was continued, though four whole days had to be devoted to the preparation of two Manatees. These absurd-looking aquatic mammals are plentiful in the Cross River, where they are much sought after by the natives for food, the flesh being exceedingly tough and lasting, though singularly uninteresting. The method of capture employed is novel if a little inhuman. Small creeks leading from the main river are closed with stakes firmly driven into the mud, except for a small entrance; quantities of leaves from the coco-yam are then thrown in. This being the favourite food of the Manatee, quite a number of individuals may enter during one night, whereupon the entrance is closed, and the wretched animals harpooned. The native who captured the young male and female for us was a noted expert, which was confirmed by the neat wound under the left flipper which penetrated the heart in both cases. The skeletons of both individuals were cleaned and preserved entire, whilst the flesh fed the whole village, all our carriers and staff, besides ourselves.

Just below Ekuri Beach throughout the dry season of 1932–33 a rather pathetic but instructive sight was to be seen. The captain of a river steamer tied up one night during the rainy season, as is customary on the journey upstream. He was aroused in the evening to find the whole craft at an unusually acute angle, and discovered that the river had dropped suddenly and he was aground. However the water again rose, and the captain, being African though doubtless seaworthy, retired peacefully to sleep, well pleased at his good fortune. During the night however the river again fell, this time by 25 feet, where it remained tranquil and silent for the next seven months. The captain walked back to Calabar to pay a fine and the craft remained elegantly poised at the top of a steep bank far from its native element, a monument to the eccentricities of the West African climate and the faith of the negro soul.

Scientific results

The expedition had its origin in a most unscientific ambition of mine, but when I came to examine its value, I found that it was so rich in possibilities of a scientific nature that I was encouraged to proceed with the business of organization and the raising of funds. The expedition was made possible by the generous financial assistance of a number of scientific bodies. The Percy Sladen Memorial Trust gave £250, the Balfour Fund £150, the British Museum £50, Trinity College (Cambridge) £200, the Godman Fund £50, the Government Grant Committee Royal Society £150, Mr. W. M. Russell £100, and I myself provided a sinking fund to defray the cost of insurance and other sundry expenses that might occur during the course of the trip. The total cost of the expedition was £980, being £8 over the estimate for the full year. I am equally indebted to Professor Stanley Gardiner and Mr. C. Forster Cooper of Cambridge, Dr. Calman and Mr. M. A. C. Hinton of the British Museum, Professor J. P. Hill of London University, and Sir Sidney

Harmer for encouragement and support. I feel that I can never say enough in expressing my gratitude to them for their kindness and real practical assistance.

As a result of the ten months' collecting, 1500 mammals, 1250 Reptiles and Amphibians, and 4000 invertebrates consisting of Spiders, Centipedes, Molluscs, and parasitic Worms, were obtained. These all reached home in an excellent state of preservation. In addition, voluminous data relating to them, together with narratives, word lists of native languages, and maps, were compiled, filling some twenty foolscap note-books by the end of the trip. Unfortunately the photographs represent only a little under half of those taken, owing principally to deterioration of the negatives after developing and the excessive humidity of the climate.

Drawings of the feet, ears, and other external features of all species of mammal were made from the freshly killed specimen. The soft parts were always examined, the stomach contents preserved and the uteri, in the case of females, subjected to special treatment for the purposes of embryological study. One hundred and fifty-four of the latter were obtained, including several in a pregnant condition belonging to species that have not previously been investigated. The external features and coloration of every individual mammal and Frog were recorded; a most laborious process which probably occupied more than half our actual hours of work while in the field. Every mammal was examined both for internal and external parasites.

The detailed scientific results are to be made known as soon as possible, but the great bulk of the material, and the fact that co-relation between our field notes and the future laboratory work will be necessary throughout, precludes the possibility of any projected papers being completed for some time to come. The actual specimens are later to be divided according to the requirements of the British Museum and the Cambridge University Zoological Museum.

There were twelve main objects projected for collection, apart from the research in the field, of which eleven were obtained, the only exception being actual specimens of a freshwater Dolphin suspected of inhabiting the waters of the great African rivers. The original scheme of work was carried out to the letter in every branch, and a most gratifying collection of material together with a number of unexpected items of great value and interest obtained. Of particular note among the latter are five hundred preserved and twenty live Podogona, aberrant Tick-like Arachnids, previously represented only by a handful of scattered specimens in the great Museums of the world.

APPENDIX

PLACE NAMES IN MAMFE DIVISION

Mamfe Division was first colonized by the Germans at the beginning of this century; it was mandated to Great Britain after the World War. Only two maps in existence approach reliability: (1) Nigerian Ordnance Survey 1924 (sheets 11 and 15); (2) Karte von Kamerun bearbeitet von M. Moisel 1912 (sheet F.I.). (1) is accurate for rivers and contours except in the extreme north; (2) has great detail, remarkable accuracy in place names, rivers mostly hypothetical,

and a great number of rivers and mountains shown by names which do not now and never have existed. A careful comparison between the 1912 map and conditions to-day reveal the fact that places do not change their names, nor the villages alter their positions so frequently as supposed.

Notes

(1) The prefix *M* to place names in this country is very misleading and does not transliterate the sounds intended in the majority of cases. If *M* precedes *b*, the sound is more nearly *ŭm*. If *M* precedes *f*, the *M* is hardly pronounced at all. In "Mpot" however it is very strong, as if Im-pot, whereas in Mtene it becomes parallel in Latin languages as Metene.

(2) An initial *N* is always strong and clearly pronounced, but never in the form *in*, or *en*. There is however another form very common among names as Ngwa, where there is a distinct catch in the breath before the word is spoken, which can only be transliterated thus: 'Ngwa.

(3) *u* before *m*, *n*, or *r* is always short, never as in "under" in English, but always as in "unter" in German.

(4) The name Bashauo presents several difficulties, the termination being almost impossible to transliterate. If *auo* be pronounced with an open mouth, an accurate rendering will be accomplished.

(5) The lengthening of a vowel makes the only difference in meaning between many words. Thus Elumbā in Bafo and Elumba in Obang.

(6) A double *aa* signifies a pronounced pause and considerable emphasis, viz.: *Mba-akum*.

(7) In Asumbo there are two forms of *l*, one interchangeable with *y* as in Ekorolu (or Ekoroyu). The other is constant, liquid, and very strong, as in Oliti.

(8) *ng* is usually as in *finger:* Otungu, Talangai; but sometimes as in *singer:* Besóngabang. See also (2).

The following is a list of the principal rivers, tribal subdivisions, and larger villages in Mamfe Division, transliterated from the various native languages in the presence of the indigenous population. The distance of each place in a direct line from Mamfe is given in kilometres together with its approximate bearings taken from Mamfe, followed by the tribal subdivision in which it is situated. Old names and inaccurate transliterations found on maps are given in parenthesis.

Abakpa ..	.. 56 km. SW.	Ekoi	
Abat ..	.. 45 km. S.	Obang	(not Abăt)
Abonando	.. 19 km. NW.	Boki	(not Abonandu)
Afap ..	.. 16 km. SW.	Deiaka	(not Afab)
Aiyuk ..	.. 38 km. W.	Ekoi	(not Ajauke)
Aiyiman	.. 57 km. SW.	Ekoi	(not Ajáman)
Aiyundip	.. 22 km. SW.	Keika	(not Ajundep, Ayiyaundip)
Akak ..	.. 32 km. SSE.	Obang	(not Akag)
Akon ..	.. 26 km. W.	Ekoi	
Akwa ..	.. 35 km. NNE.	Anyang	(not Akŏá)
Āma ..	.. 69 km. NE.	Asumbo	
Amālivīr	.. 70 km. NE.	Asumbo	(not Amolive, Amarlivear)
Amasi ..	.. 64 km. NE.	Manta	(second *a* short but stressed)
Ambele ..	.. 40 km. NE.	Menka	
Amébesu	.. 32 km. NE. by E.	Menda	(not Amebessu)

Anyang ..	.. (Tribal subdivision north of Mamfe)		
Araru ..	.. 38 km. SW. by W.	Ekoi	
Arsebong	.. 40 km. S.	Obang	(not Arsibong)
Asam ..	.. 30 km. N.	Anyang	(not Assam)
Ashum ..	.. 22 km. SSE.	Banyang	(not Aschum)
Asiunda	.. 58 km. NNE.	Anyang	(not Ashunda, Aschunda)
Ásumbo..	.. (Tribal subdivision north of Mamfe)		(not Assumbo)
Atibong	.. 61 km. SE. by E.	Banyang	(not Atebong)
Átolo ..	.. 56 km. NNE.	Assumbo	
Ayi ..	.. 61 km. NE.	Manta	(not Ayi, Aji)
Ayiwawa	.. 34 km. NE. by E.	Menka	(not Ayiwawa, Ajiwawa)
Ayiwawa	.. 18 km. SW. by W.	Keika	(not Ayiwawa, Ajiwawa)
Bābu ..	.. 45 km. SSW.	Obang	(not Bardjo)
Báchuntai	.. 10 km. SE. by E.	Banyang	(not Bachor-ntayi, Ntaï)
Badshāma	.. 54 km. NNE.	Asumbo	(not Badschama, Bajama)
Bāfo ..	.. (Tribal subdivision SE. of Mamfe)		
Baji ..	.. 34 km. NW.	Boki	(not Bagi, Badje)
Bākā ..	.. 50 km. NE.	Manta	
Bakébe ..	.. 32 km. SE.	Banyang	(not Bakĕwé)
Bakuku ..	.. 32 km. S.	Obang	(not Bakore)
Bakumba	.. 34 km. NE.	Menka	(not Bakumba)
Bakút ..	.. 40 km. SW.	Obang	(not Bakut)
Balégete	.. 80 km. NNW.	Ikom Div., S. Nigeria	(not Alegeti)
Bali River	.. (Southern tributary of Cross River at Mamfe)		
Bāmumbu	.. (Tribal subdivision E. of Mamfe)		
Bangwa ..	.. (Tribal subdivision SE. of Mamfe)		
Bantakpa	.. 56 km. NE.	Manta	
Banyang	.. (Tribal subdivision around Mamfe)		
Baru ..	.. 56 km. S.	Obang	(almost Bŭru)
Bashakagbe	.. 16 km. SE. by E.	Banyang	(not Basha-akagbe or Akagbe as on maps)
Bashauo..	.. 46 km. NNE.	Anyang	(not Basho, Bascho, Bashor)
Baunde ..	.. 48 km. NE.	Manta	
Beikor ..	.. 2 km. NW. by W.	Banyang	(not Bakor)
Besem ..	.. 22 km. SW.	Keiaka	
Besóngabang	.. 6 km. S.	Banyang	(not Bésong-ábang, Besonawang)
Béteme ..	.. 16 km. NW.	Anyang	(not Betime)
Bŏdam ..	.. 37 km. NW.	Boki	(not Bŏdam)
Bōki ..	.. (Tribal subdivision to NW. of Mamfe)		
Cross River	.. (Conventional name for Old Calabar River up to Mamfe)		
Dāre ..	.. 37 km. NW.	Boki	(not Dari)
Defang ..	.. 38 km. SE.	Banyang	(not Defang-eonga)
Ebe River	.. (Northern tributary of Northern Munaia)	Anyang	
Ekoi ..	.. (Tribal subdivision to W. of Mamfe)		(not Abuk)
Ekókisan	.. 29 km. NNW.	Boki	(not Ekóĕssem)

Ekónemanáwa ..	46 km. SW. by W.	Ekoi	(not Ekoneman)
Ekónemanóyong	69 km. SW.	Ekoi	(not Ekoneman)
Elumbā	56 km. SE.	Bafo	(not Elumbass)
Elúmba	50 km. SSE.	Obang	
Ésegam	16 km. NW.	Keiaka	(not Esagam, Esagem)
Eshōbi	10 km. NE.	Banyang	(not Eschobi, Eshŏbi)
Étewang ..	59 km. SE.	Bafo	(not Etawang)
Etínkam ..	40 km. SSE.	Obang	(not Ekindam)
Ewurri	18 km. SW.	Keiaka	(not Ewuri)
Eyang	14 km. NE. by E.	Banyang	(not Eang)
Fainschang ..	26 km. SE.	Banyang	(not Feinschang, Feintschang)
Faitok	24 km. SSE.	Banyang	(not Feitok)
Fonjungwa ..	72 km. SE. by E.	Bangwa	(not Fónju-ngwâ)
Fontem	74 km. SE. by E.	Bangwa	
Fosóngo ..	69 km. SE. by E.	Bangwa	(not Fosso-ngŏ)
Fótabong ..	64 km. SE.	Bangwa	(not Fōtabong)
Foto	74 km. SE. by E.	Bangwa	
Fózimo	74 km. SE. by E.	Bangwa	(not Fōsi-mŏ)
Fozimondi ..	80 E.	Bangwa	(not Fosimongdi)
Iang	40 km. SE.	Banyang	(not Eang)
Iantschang ..	10 km. SW.	Banyang	(not Eantschang)
Ínokun	39 km. SW. by W.	Ekoi	(not Inokum)
Itu	42 km. SW. by W.	Ekoi	
Kajīfu	29 km. NW.	Boki	(not Gadjifu)
Kasam	14 km. N.	Anyang	(not Kescham, Kessem, Kassam)
Keiaka	(Tribal subdivision to W. of Mamfe)		(not Keaka)
Kotīle	67 km. NNE.	Asumbo	(not Otile)
Mainyu Bridge..	29 km. SE. by E.	Banyang	(new village, conventional name)
Mainyu River ..	(Cross River above Mamfe)		(not Manju)
Makwe	51 km. NNE.	Anyang	
Mamfe	—	Banyang	(not Ossidinge)
Manta	37 km. NE. by E.	Manta	
Manta	(Tribal subdivision to NE. of Mamfe)		
Mbáabon ..	35 km. SW.	Ekoi	(not M'băbon)
Mbáakum ..	22 km. W.	Ekoi	(not M'baakam)
Mbenyan ..	32 km. W.	Ekoi	(not M'bendjan)
Mbinda	58 km. SW.	Ekoi	
Mbinjong ..	22 km. SE.	Banyang	(not Binjong)
Mbíofong ..	54 km. SW.	Ekoi	(not M'bafong, N'biofang)
Mblishi	54 km. NNE.	Anyang	(not M'blishe, Blishe, Blische)
Mbo	75 km. SE.	Bangwa	
Mbōbu	50 km. SW.	Ekoi	(not Kl. Mbobuē)
Mbu River ..	(Southern tributary of the Mainyu E. of Nda-Ali)		
Mbulo	48 km. NE.	Manta	(not M'bulo)
Menka	48 km. NE.	Menka	(not Tanka)

Menka	(Tribal subdivision to NE. of Mamfe)		
Mfakwe	35 km. NNE.	Anyang	(not M'fakŭe)
Mfuni	13 km. SW.	Keiaka	(not M'fun)
Mo in Banyang Mam in Widekum Moma in Manta	(A northern tributary of the Mainyu traversing three tribal language groups)		
Mpot	13 km. SW.	Keiaka	(really Umpot, written conventionally, M'pot)
Mtena	59 km. N.	Asumbo	(not Matena)
Mukonyong ..	16 km. NE.	Anyang	
Mukúmunu ..	64 km. NNE.	Asumbo	(not Bakŭmĕnŏ)
Munaia River ..	(Northern tributary of the Cross river)		(not Mun-aya)
Munaia River ..	(Southern tributary of the Cross River)		(not Mun-aja)
Nchang	7 km. SSW.	Banyang	(not Ntschang)
Nda-Ali Mt. ..	32 km. SE.	Banyang	(pronounced Inderali, except by Baiangis)
Ndebaiya ..	37 km. W.	Ekoi	(not N'dewaja)
Ndege	19 km. SW.	Keiaka	(not Ndschege)
Ngali	77 km. NNE.	Asumbo	(not N'gale)
Nguti	53 km. SSE.	Obang	
Nkórekong ..	30 km. SW.	Keiaka	(not N'kore)
Nsánakang ..	40 km. NW. by W.	Ekoi	(not N'ssanakang)
Nsanarăti ..	45 km. NW. by W.	Ekoi	(not Nssan-Aragti)
Ntakwo	50 km. NE.	Manta	
Ntámele ..	56 km. NNE.	Asumbo	(not N'temele)
Nyang	24 km. NNE.	Anyang	(not Njang)
German Obokum	22 km. NW.	Ekoi	(conventional, but universally used)
British Obokum	48 km. NW. by W.	Ikom Div., S. Nigeria	
Ōbang	(Tribal subdivision W. of Mamfe)		
Obŏni	42 km. N.	Anyang	(not Obonyi)
Oiyive	72 km. NNE.	Asumbo	(not Yive, Eve, Ijve)
Okágele	67 km. NNE.	Asumbo	
Okoiyong ..	6 km SW. by E.	Banyang	(not Ekojong)
Okorōba ..	37 km. S.	Obang	(not Okorowa)
Okpambe ..	42 km. NNW.	Boki	(not Okoambe)
Okúlikang ..	35 km. SW. by W.	Ekoi	
Okum	42 km. NNW.	Boki	(not Okum)
Okuri	56 km. SW.	Ekoi	
Oliti	77 km. NNE.	Asumbo	
Olulu	57 km. NNE.	Asumbo	(not Olulo)
Osătu	67 km. NE.	Asumbo	(not Ossatu)
Otu	48 km. W.	Ekoi	
Otungu	67 km. NE.	Asumbo	(not Otungo)
Ōyi	29 km. NW.	Boki	(not Oji)
Ōyi	(Northern tributary of Cross River in Boki Country)		
Oyomōjok ..	35 km. W.	Ekoi	(not Eomodjo)
Takamanda ..	30 km. N.	Anyang	
Takpe	30 km. N.	Anyang	(not Tawi, Dakpe)
Tálangai ..	22 km. S.	Banyang	(not Talangeie)

Tăle ..	.. 43 km. SE.	Banyang	(not Tali)
Tanga ..	.. 59 km. SE.	Bafo	
Tawo ..	.. 19 km. W.	Keiaka	
Tembong	.. 40 km. SE.	Banyang	(not Temang, Tembang)
Tinta ..	.. 61 km. NNE.	Asumbo	(not Tenta)
Tinto ..	.. 40 km. SE.	Banyang	
Wetchu ..	.. 48 km. NE. by E.	Menka	(not Wetschu, Otschu)
Wídekum	.. (Tribal subdivision to NE. of Mamfe)		

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: The title of the lecture this evening is The Mamfe Basin, British Cameroons, and the lecturer is Mr. Ivan Sanderson. Mr. Sanderson is a B.Sc. of Cambridge, and had only just finished at Cambridge when he went on the Percy Sladen Zoological Expedition in August 1932–33, spending nearly a year in the British Cameroons. The corner of that country in which he has worked is very little known, and there is scope for a great deal of intensive exploration, both in regard to geography and zoology. Mr. Sanderson and two biologists, Mr. W. M. Russell and Mr. P. H. Seaton, went under the auspices and with the support of a number of scientific bodies among which were the British Museum, Trinity College (Cambridge), and the Government Grant Committee of the Royal Society. You will gather from Mr. Sanderson's paper that the expedition was extraordinarily interesting, especially from the zoological point of view. Mr. Sanderson was engaged mainly on zoological work, but there is a great deal in his paper which is of geographical interest. I will now ask Mr. Sanderson to read his paper.

Mr. Sanderson then read the paper printed above, and a discussion followed.

The PRESIDENT: I will ask Mr. Seaton, who was the companion of Mr. Sanderson during this very interesting trip, to come and give us a few words from his point of view of the work which he was doing on the expedition. Incidentally, he will unveil a touching memorial to the Survey element in the expedition.

Mr. P. H. SEATON: I came with the intention of thinking out a few words to say, but I have been so taken back to Africa by the lecture that I have not been able to think out anything. It was a very small expedition. As you have gathered, it started with two, Mr. Sanderson and Mr. Russell, and then in 1933 I went out and became a nuisance. Any one would agree with my colleagues if at about one o'clock in the morning, when everybody felt like nothing more than bed, a newcomer such as I should appear in the doorway and fling a bundle of fur on the table—more animals to be skinned before bed. The main object of the expedition was zoological, so that we were all doing the same kind of work. As there were only three of us, we were co-operating very closely the whole time, and the experience of one was the experience of all three. We did however have departments to ourselves. Russell was looking after the food and domestic side; I am afraid my arrival rather upset his calculations once again. Everything was worked out, even to the lumps of sugar consumed. It was reckoned that two people ate ten lumps of sugar in one day; therefore for forty-days' trek in the bush, so many lumps of sugar would be needed for three people. I am afraid I quite horrified them because I had a different appetite to the rest of the party.

My particular field was photography, and it was extremely difficult, going

out without any previous knowledge of tropical photography, to find that the atmospheric conditions upset all photographic materials. They seemed to slow down the emulsion of the films and it was very difficult to obtain good results. There never seemed to be enough light, and the results tended to be foggy and bad. When we got to Asumbo we seemed to turn over a new leaf. We came into a district that no one knew very much about, and it was all very fascinating and rather like a new breadth of vision: we felt we were going to do innumerable things. Looking around, we saw marvellous country, practically unmapped. Unfortunately, we had no instruments, but we thought we ought to do something about it, so we broke up chairs, old kerosene tins, and odd things like that, and rigged up the contraption which I now unveil. You will note the telescopic sight from a rifle, and the pointer. It is really surprising what one can do with such a primitive theodolite.

The PRESIDENT: There are not many with us to-night who know the country. Mr. Bannerman, would you add a word or two from the zoological point of view?

Mr. BANNERMAN: I regret that from the point of view of the ornithologist we know absolutely nothing about the bird-life of the country which the lecturer has described to-night—that is to say, the Mamfe Basin. I hope if and when Mr. Sanderson returns to that part of the world he will endeavour to find out something about the birds which inhabit it. The highlands of Cameroon possess many species of great interest to science, and a collection from farther west would throw valuable light on the distribution of birds in that part of Africa. I hope the lecturer will bear that in mind should he ever return.

The PRESIDENT: Our sphere of geography nowadays is very catholic. As you know, we interest ourselves in many aspects of geographical science, including anthropology; and although what we have seen to-night, as the lecturer has told us, is mainly zoological, there has been a great deal of interest to us as geographers, for we have been able to gain from it some conception of the character of the country and of the people who inhabit it. You will agree with me that it was a very fine performance on the part of these three young men straight from the University to undertake this small expedition of only three members and to perform so thoroughly the work they set out to do. It must be remembered that the climate they were working in is ordinarily a very dangerous one. Yellow jack, I believe, is by no means exterminated, and malaria is of course rampant in many places. On the whole they were extraordinarily fortunate; except for a few attacks of fever, they got through wonderfully well and we can congratulate them on coming home as fit as they have. The resourcefulness and enterprise of Mr. Seaton in the manufacture of scientific instruments such as the tin theodolite which he has just shown us will I am sure appeal to you! We thank Mr. Sanderson and his companions very much indeed for a most interesting evening.

POPULATION MAPS: *A Discussion at the Afternoon Meeting of the Society on 17 December 1934, opened by*

PROFESSOR C. B. FAWCETT

THE population map has become more important with every advance in the study of human geography and its application to problems of social organization and administration; for the distribution of human population over the land, and its arrangement in various types of settlement, is the chief resultant effect of the whole complex of geographical, economic, historical, and social conditions in which the people have developed. It is also a starting-point for any planned organization of the community. Hence it is important that we should have the best possible maps representing the distribution and arrangement of the population at any given time.

At the recent International Geographical Congress in Warszawa one section, Human Geography, received a group of papers on methods of constructing such maps, and the special lecture by Brig. Winterbotham was devoted to the O.S. Population Map of Great Britain. Some of the material presented here is in part based on those papers; but I hope that the description of methods of construction may be so condensed as to leave time for a useful discussion of the limitations of these maps, and of the comparative values of the different methods in varying circumstances.

There are three facts, or groups of facts, which one may attempt to show on population maps—either singly or in combination. They are:

(1) The actual number of the people within given areas.

(2) The density of the population.

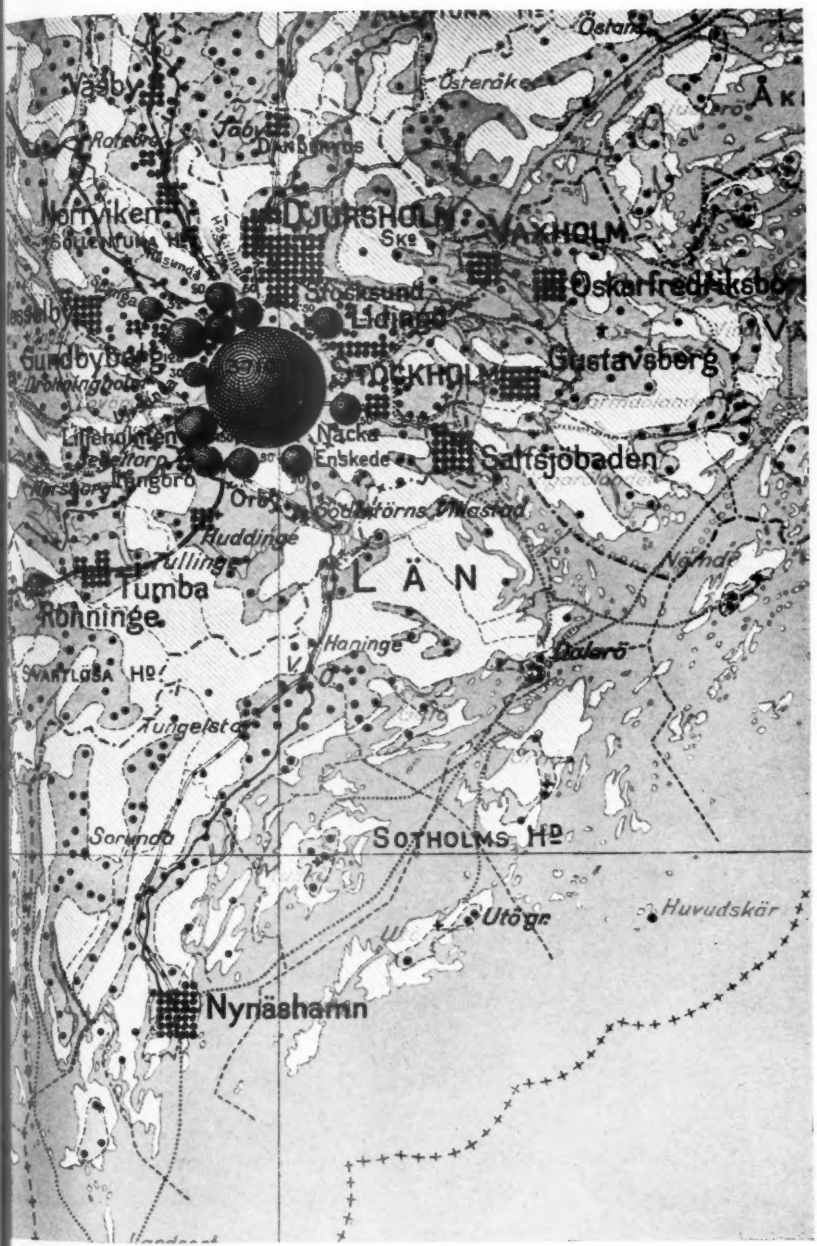
(3) The grouping, or arrangement, of the population.

And the value of any particular method of construction is to be judged by its success in representing one, or more, of these facts.

For all population maps the material for the construction is of similar form. The compiler knows, either from census returns or from the best available estimates, the numbers of inhabitants within defined areas. He may have, in addition, either from good large-scale maps or from more or less incomplete reports, information of the position of the habitations in towns, villages, or isolated hamlets or houses. Where there are reliable census returns (and here we need not deal with other cases) the areas to which they refer are usually those of local government units, in this country rural parishes and "wards" of urban areas. The smallest areas dealt with may be those of the individual census enumerators; but the figures for these are not usually published and are rarely available. It is desirable in mapping to use the smallest unit-area for which statistics are available.

Usually the population is distributed unevenly over even the smallest unit-area. And this unevenness forms the chief difficulty in the making of an adequate population map. The crux of the problem of how to produce a good map, whatever method is adopted, is how to determine the true distribution of the population within the several statistical unit-areas.

Two methods of representation are in general use: (1) The Dot Method, which has been developed to a considerable degree in Scandinavia and the



Part of Sten de Geer's Population Map of Sweden, 1917: 1 : 500,000 and 1 dot to 100 persons. (*See p. 143*)

Part of Population Map of Manchester on the scale of twelve inches to the mile, here reduced to four inches to the mile: 1 dot to 25 persons. Produced in 1932 by the City of Manchester Civic Survey (Public Health and Housing Section). *(See p. 149)*

United States; and (2) The Shading Method, which is perhaps more widely used in this country and the rest of Europe. In each case there are two chief variables, each of which can be adjusted within fairly wide limits to suit the purposes of the particular map. These are (*a*) the scale of the base map; and (*b*) the scale, or scales, of the dots *or* the type and range of the shadings to be used.

Also in both types of map the base map can be varied to some extent. With the Dot Method the background can be coloured to show relief, or land utilization,[1] or political units.[2] While with the Shading Method the background can also show many lines, of rivers or roads and railways, etc., but no continuous colouring.[3]

The Dot Method

In the simplest case of this method a dot, of uniform size and shape, represents a stated number of individuals, and the dots are so distributed as to represent as nearly as possible the situation of that number in the area. On such maps as those of the Agricultural Atlas of England and Wales the dots on each map are uniform. This is also practicable on some population maps, where the scale of the map is large in proportion to the density of population or where the distribution is very even.[4] It has also been used on maps of very small scale with a dot representing a very large number of people.[5] But in most population maps it is impracticable to keep to one uniform dot, because it is necessary to represent a fairly large area over which the distribution is not sufficiently even. The difficulty arises with the attempt to place on one sheet a representation of the distribution of both rural and urban populations. To attempt to show a considerable town by dots on a scale appropriate to the small clusters of rural inhabitants would cover with such dots an area far larger than that actually occupied by the town. This would make it impossible to show any population near to, but outside, the town.

This difficulty can be overcome by varying the dot, which can be done in several ways. The simplest is to have dots of different sizes and/or shapes, each representing a given number of inhabitants.[6] Of the many possible variations for this purpose the best known is that developed by the late Professor Sten de Geer and his school. This uses a uniform dot to represent the distribution of population in all areas except towns of more than a defined population, which is reached where the town would require too many dots to be got into the space available on the map. At this stage a change is introduced. The whole population of the town is represented by a single dot, usually

[1] As in Sten de Geer's Karta över Befolkningens Fördelning i Sverige (Stokholm, 1917); and J. G. Granö's map of Finland in No. 6 of *Publications of the Geographical Institute* of the University of Turku, 1931.

[2] As on Söderlund's Population Map of Europe (Stockholm).

[3] Cf. Brig. Winterbotham's note on "Dots and Distributions" in *Geography*, September 1934, vol. xix, pp. 211–213.

[4] *E.g.* on sheets of rural areas in the Atlas of Sweden (note 1).

[5] As on the population map in Nordisk Varld Atlas, plate 45 (Stokholm 1924); and on P. M. Roxby's population map of China in the *Geogr. Rev.* 1925, vol. xv, p. 5.

[6] *E.g.* on the map on p. 102 of the *Geogr. J.*, February 1932, vol. 79; on Dr. Granö's map of Finland referred to above; on the population map of the northern territories of the U.S.S.R., and on some of the maps referred to later.

shaded to look like a sphere, on a scale different from, and independent of, that of the small uniform dots which represent the rural and small-town populations.[1] In de Geer's maps this "sphere" is of a size determined by making its radius proportional to the cube root of the number of inhabitants in the town on a suitable scale; *i.e.* a scale on which the smallest town is represented by a sufficiently visible dot and the largest by one not too large for the map. The method has been used to produce very graphic maps of which a good example is that of Europe, on 1 : 4 M, by Dr. A. Söderlund of Stockholm.

An interesting variant for the towns is used on the diagrammatic population map of Canada issued with the report of the 1931 census. Here towns of more than five thousand inhabitants are shown by hollow circles of area proportional to their population. These are much less prominent on the map than are the "solid" spheres; and they do not appreciably interfere with the representation of neighbouring population-units, *e.g.* several suburban towns are shown inside, or overlapping the large circles which represent Montreal and Toronto respectively. For close study these open circles have some advantages over the "solid" spheres; but they are much less emphatic: in fact, it is possible to miss them altogether in a cursory glance, and so to obtain a quite misleading impression. This weakness may be avoided, at the cost of a slight loss of clarity, by filling the circles with a light shading, as in Dr. Wesley Coulter's map of Japan on the same system.[2]

In relation to the facts to be shown by, or on, population maps (above, p. 142) it seems that the Dot Method can show the actual numbers of the people within the limits of its scales, though the vividness of this representation varies greatly on different dot maps, and it usually needs close examination and laborious counting of the dots. This method does not give more than a general impression of density of population, except after very laborious counting and calculation. But it can, on large scales, give a very good representation of many important facts of the grouping of the population.

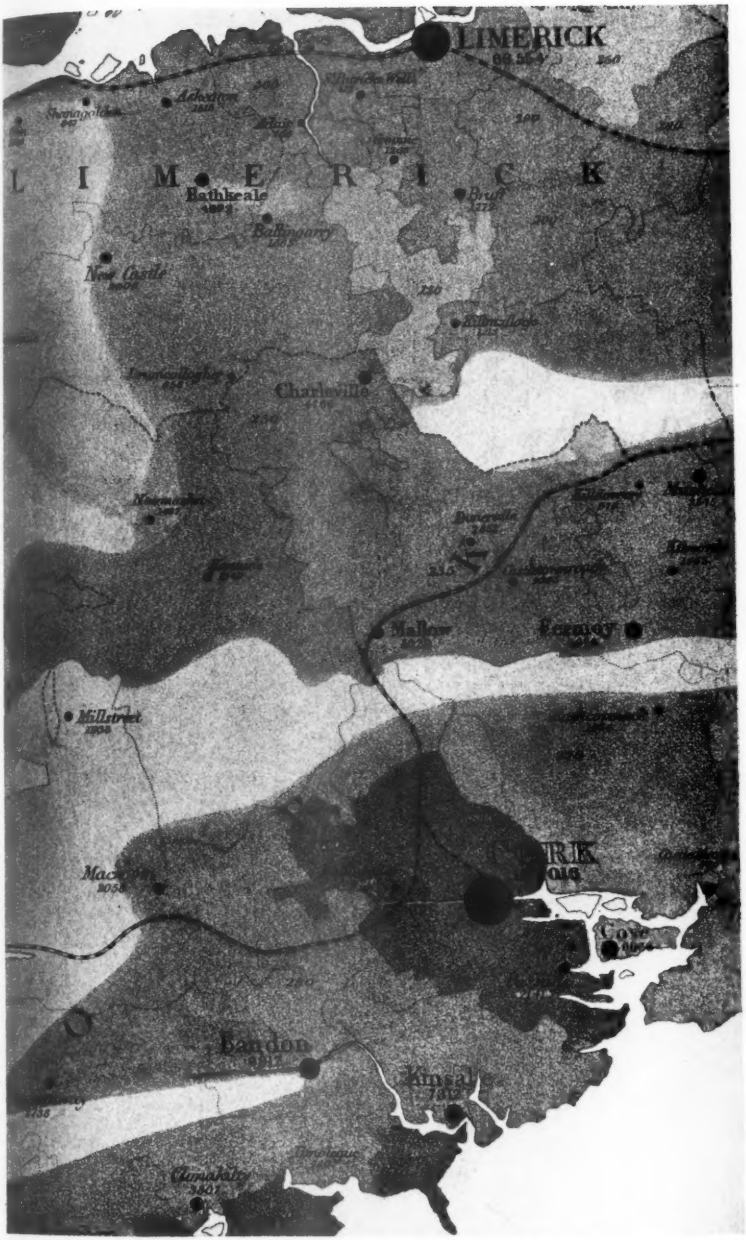
The Shading Method

In the simplest form of the Shading Method each unit-area on the map is covered with the appropriate shading or colour, and the boundaries between the shades are the boundaries of those areas, as *e.g.* on the Population Map in the Atlas de France, where the unit-area is the commune. This is least unsatisfactory where the unit-area is a very small fraction of the total area of the map; but it is never quite satisfactory because such boundaries have no necessary relation to the distribution of the population. There are two methods of getting over this difficulty of the arbitrary nature of such boundaries. In the first, which was employed in the production of the O.S. 1/M Population Map of Great Britain, the boundaries were "generalized" after the determination of the densities in the several unit-areas. Such generalization obviously introduces possibilities of error, and it is desirable to know its methods, and limits, for any important map on which it is used.[3] The second

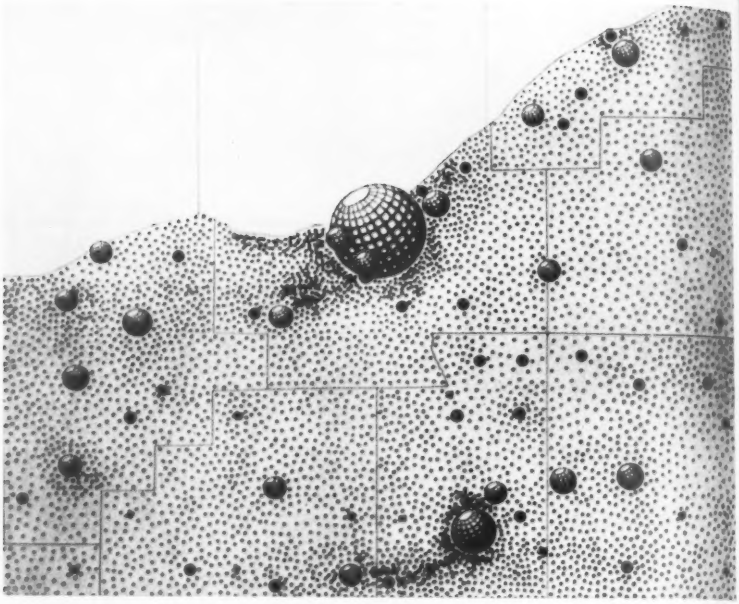
[1] This method is described by its author in an article in the *Geogr. Rev.*, January 1922, vol. xii, pp. 72–83.

[2] In *Geogr. Rev.*, April 1926, vol. xvi, opp. p. 284.

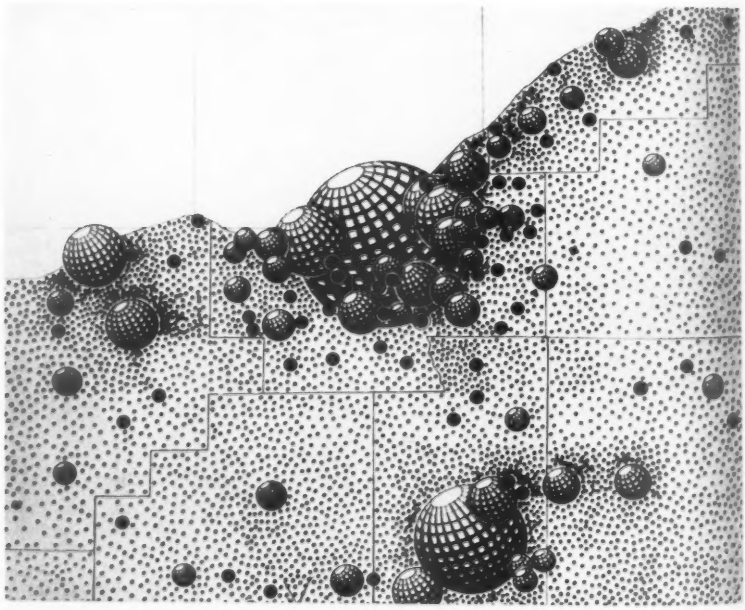
[3] So far as I know it was first used by F. Bosse, in the production of the population maps of England and Wales, and Scotland, in Bartholomew's Atlases of those countries;



Part of a Population Map prepared in 1837 by H. D. Harness for the Second Report of the Railway Commissioners for Ireland. (*See p. 151*)



Part of a Population Map of Ohio for 1880 by Dr. Guy-Harold Smith (1 dot to 25 persons); original maps 1 : 500,000, photostat reproductions (as above) approx. 1 : 1,000,000. *(See p. 156)*



The same section of Dr. Guy-Harold Smith's Population Map of Ohio for 1930

method of avoiding the arbitrary "unrelated" boundary between density-shades involves calculating, or estimating, the actual density of a large number of well-spaced areas, each small enough to justify us in regarding the density as nearly uniform within that area. This density is then regarded as the density at the centre of its area and plotted on to the map; and among all the densities so obtained isopleths of population density are drawn just as contour lines (which are isopleths of altitude) are drawn by reference to spot heights. This second method was used by Mr. B. C. Wallis in a paper read to the Society in 1915;[1] and the maps which illustrate that paper are worthy of careful study for their cartographic method. I believe that Mr. Hinks shares with the author of the paper the responsibility for the maps.

In relation to the facts to be shown (above, p. 142) it appears that the Shading Method can be made to give a much better representation of the distribution of Density of Population than is usually achieved by the Dot Method. And, by a comparably laborious method of calculation it can be used to calculate the approximate number of the people in a given area. But it appears to be decidedly less successful in the representation of the arrangement of population.

The chief obstacle which hinders the production of completely accurate population maps seems to be independent of the cartographic method used. It is the lack of sufficiently detailed accurate knowledge of the local distribution of the population as a guide for the placing of the dots, or for the generalization of the boundaries between shadings, or for the placing of "spot" densities. The probable errors due to lack of local knowledge may not vary very much for the different methods of representation; but they certainly vary with the scales of the map, though not in any mathematically definable ratio. The larger the scales the greater the errors which are likely to appear when the map is compiled without an adequate knowledge of the local geography. Such errors may be quite inappreciable on population maps of continents or large countries; they become considerable on maps of counties or smaller areas.

It is clear from the examples we have seen that it is possible to produce good and vivid population maps on both methods; and it is also possible to make bad maps on both. At the two extremes of very small scales, as on Professor Roxby's China (about 1 : 12,500,000 and one dot to 25,000 persons) and Dr. Wesley Coulter's Japan (1 : 8,000,000 and one dot to 10,000 persons),[2] and quite large scales, as the Manchester City map (12 inches to a mile or 1:5280, and one dot to 25 persons) and Sten de Geer's Sweden (1 : 500,000 and one dot to 100 persons), the Dot Method seems to have considerable advantages; though it is not necessarily best for all purposes. At intermediate scales, such as the 1 : 1,000,000 of the International Map, and in densely peopled areas, the relative success of the different methods is doubtful. On this scale there are the Ordnance Survey's Population Map of Great Britain

but I have not been able to learn particulars of the methods used for those maps. Such generalization, on defined methods, is seen in the population maps of the U.S.S.R. (Carte dasymétrique de la Russie d'Europe) published by the Institut d'Etudes, "Le Sol et le sous-sol," Leningrad 1923——.

[1] "Distribution of Nationalities in Hungary," *Geogr. J.*, March 1916, vol. 47, pp. 177–188.

[2] Map in *Geogr. Rev.*, April 1926, vol. xvi, opp. p. 284.

(shaded, by generalization of boundaries)[1] and the dot maps of Norway by Dr. A. Söderlund, of Finland by Dr. J. G. Granö, and of Estonia by Professor A. Tammekann. It is unfortunate for purposes of comparison that all three of these deal with countries which are very thinly peopled in comparison with Great Britain. A very interesting dot map on an intermediate scale is that of Pennsylvania by Dr. C. E. Batschelet (1 : 2,800,000 and one dot to 200 persons).[2] This is a successful population map in that it succeeds in giving a vivid picture of the distribution of population over the state, within the limits of its scales. Another case in which the Dot Method has been used with great success is in the series of population maps of Ohio, and of Wisconsin, at different dates by Dr. Guy-Harold Smith.[3] The changes in distribution of the rural population and the growth of the cities are both shown very clearly; and it is difficult to imagine that this could have been done equally well by any method of shading. This method is also used by Dr. J. Haliczer in his three comparative maps of the population of Europe for 1720, 1820, and 1930.[4]

A primary fact to be considered in deciding on the most suitable methods of construction of population maps is that the individuals and groups who compose the population over any area are discrete units. Population is discontinuous; and so it can only be accurately represented by some discontinuous markings on the map, such as the dots and other symbols used in the Dot Method. While "Density of Population" is an abstract concept which may be regarded as uniform over limited areas, and therefore capable of correct representation by uniform shades or colours over those areas, the actual inhabitants are in fact "dotted about" the surface. And hence the Dot Method is capable of the nearer approximation to a true representation of both the actual numbers and the grouping, or arrangement, of the population.

Before Professor Fawcett's introductory paper the PRESIDENT (Major-General Sir PERCY COX) *said:* This afternoon we are going to have a discussion, which I hope will prove very interesting, on the subject of Population Maps and the different methods for showing density of population. Professor Fawcett, as you know, is a former member of our Council and occupies the Chair of Geography at London University. He is a man with a European reputation as a geographer and was one of the British party who attended the Geographical Congress at Warsaw in August last. What he will have to say this afternoon is partly the outcome of what we heard there from different points of view in regard to this particular question. Professor Fawcett will be very brief, as there are several distinguished geographers present to whom the subject is of extreme interest and we hope for a full discussion; so that I will not keep Professor Fawcett from opening the subject.

[1] See review of this map in *Geogr. J.*, September 1934, vol. 84, pp. 258–260.

[2] Map in *Geogr. Rev.*, July 1927, vol. xvii, p. 430.

[3] Those for Wisconsin, 1850, 1860, 1870, 1880, 1900, and 1920 were first published in *Transactions of the Wisconsin Academy of Sciences*, 1929, vol. xxiv, pp. 53–107. Sets of these maps, to 1930, have been presented to the R.G.S. by the author, and may be seen in the Map Room. See present discussion *infra*, p. 156.

[4] In *Geography*, December 1934, vol. xix, pp. 265, 266, 267.

Professor Fawcett then read the paper printed above, and the discussion followed.

The PRESIDENT: First let me say that I have received some comments from Sir CHARLES CLOSE, who was, regrettably, unable to come to London to-day. He writes:

Professor Fawcett's paper is a useful sequel to the discussions which we had at Warsaw upon the same subject. In particular, the lecture given by Brigadier Winterbotham, to a large general audience, on August 24, was a clear and well-illustrated exposition of the various problems which arise. After that lecture Dr. Isaiah Bowman raised the question as to the method of generalizing the densities in the unit areas so as to produce a shaded map. If I remember rightly the answer was that no definite method had been evolved, and that the system depended to a large extent on the skill of the map-maker. But, in spite of that drawback, the shading method is a valuable one for showing the distribution reduced to simple terms. I have before me, as I write, the Ordnance Survey Population Map of Great Britain, Northern Sheet; this would be hard to improve upon.

But, while both the dot and shade methods have their uses, we also need a system which shall exhibit graphically the movements of population. I have seen some of Professor Fawcett's slides, and one of them, which gives, in colour, the positive and negative changes of population in this country, between the censuses of 1921 and 1931, is an excellent graphic presentation of the case. And, in this connection, I would draw attention to his valuable article in the last issue of *Population*, the journal of the International Population Union, in which he shows very clearly the area of marked concentration which extends diagonally across England, in which three-quarters of the increase of population occurred during the last inter-censal period. In this area the density approaches 1500 to the square mile!

Brigadier H. St.J. L. WINTERBOTHAM: The technique of producing Population Maps is one upon which we have come to no general conclusion so far, and I think all those who are interested in the subject will be grateful to Professor Fawcett for opening this discussion. I do not think however that Professor Fawcett's division into the dot method and the shading method is quite a satisfactory one. For example the dot itself can be used as a method of shading, and furthermore the shading includes, as I understand Professor Fawcett defines it, all methods possible in the use of colour. Now the use of colour allows of a large variety of treatment, and there are certainly two main uses in respect of the system which is chosen to represent changes of density. Their relative merit depends upon whether the eye can readily follow the exact meaning of the spectroscopic scale, or whether it is not better helped by a continuous alteration of tone value. The French and British maps differ widely in this respect.

To talk more particularly about that dot method in which each dot represents a certain number of inhabitants I feel bound to call attention to a fact which Professor Fawcett has not mentioned. It is of course impossible on any topographical scale to show population by dots of the same size unless those dots themselves represent a considerable number of inhabitants. The density of population in English cities is such that there is no room for any dot dis-

tribution of that sort, and therefore we fall back upon Sten de Geer's enlarged dot. Now that enlarged dot, or sphere, whether it be tinted, whether it be shaded, or whether it be open, is naturally a circle, and that circle bears no relation to the shape of the actual area whose population it pretends to show. Moreover topographical maps never do show the administrative divisions within large centres, so that you lose any chance you otherwise might have of showing the distribution within the urban limits. Again Professor Fawcett states that with a dot distribution you can show population upon a coloured background which itself carries information with regard to the utilization of the soil. I do not for a moment agree. In fact such a dual purpose map would only be possible if the dots were relatively few in number, each of them representing a very large number of people, *i.e.* for the most general small-scale maps. Otherwise the significance of the black plate carrying those dots would be lost to the eye in an attempt to serve too many purposes.

But perhaps the chief criticism I have to make upon Professor Fawcett's opening remarks is that on the bottom of p. 144 he states that the boundaries of densities on the Ordnance Survey 1/M Population Map have been generalized. That is not true. These boundaries have, on the contrary, been particularized. The boundaries are not administrative boundaries as Professor Fawcett properly points out; they are boundaries of density. It will be remembered that the basis of the Ordnance Survey map is the 1931 Census as given for parishes and wards. To reproduce a map as a pure illustration of that evidence would of course be very misleading, particularly in places where the bulk of the population is concentrated in comparatively small portions of the parishes and wards concerned. It is indeed a map made as a pure illustration of the Census which is itself generalized. To bring this map more into line with the facts of the case the housing and the topography must be studied. It is of course perfectly open to anybody to question the accuracy of the Ordnance Survey map; it is not open to anybody definitely to deny it unless proof has been gathered. It is certainly wrong to consider it as a generalized map, for it is obviously far less generalized than its French opposite number or than Sten de Geer's 1/50,000. I should like to state that in my opinion the Population Map for the expert, and the Population Map for the public, must needs be different articles. The broad conclusions which most people desire to draw do not go down to the actual numbers resident in this or that locality. For those actual numbers one must pass to the Census. To my mind the best map which has ever attempted to supplant the Census in this particular is one which I showed at the Warsaw meeting and which is due to Dr. Uhlig and to Professor Hettner.

Finally, population maps may obviously be either absolute or relative in character, for it would be perfectly possible on whatever system of representation was chosen to show changes of population within a given period as easily as to show the absolute population at any given epoch. Even there however I think it is probable that the best answer is to put into periodical publication a map showing the absolute population at the time of each census. The relative value would be obtained swiftly from an inspection of the series. For all that, a "Change of Population" map would be very interesting. It may interest the audience to know that a population map at the scale of $\frac{1}{2}$ inch

to the mile of the Greater London area is now in hand. Of that map I should have liked to produce two editions, the one at 12 noon and the other at 12 midnight. Alas, the difficulties of collecting the data for the first mentioned appear at the moment insuperable.

The PRESIDENT: I will call now upon Professor Fleure, who is Professor of Geography at Manchester University. Some of the maps you see on the wall deal with the population problem of that City.

Professor H. J. FLEURE: The Manchester civic authority has been much concerned with overcrowding in the City and has experimented with population maps for its own use. On the scale of 12 inches to the mile the dot system can be of considerable use to those actually working at the problems concerned. I rather agree with Brigadier Winterbotham's criticisms of what he calls the dot and football method, and we have been working a good deal at maps on the shading system under the direction, and with the advice, of Mr. Hart, of the Ordnance Survey. On the whole, for maps rather larger or rather smaller than the 1/M scale, this is a very useful scheme.

The scheme of using the spectroscopically graded colours, or something of that kind, has been tried in connection with maps of districts of England for various censuses, but so far without satisfactory results. The difficulty under that system is to emphasize the census of greatest density in the proper way and to avoid drawing too much attention to the middle part of the scale. The yellows on some of the maps stand out very conspicuously, but they represent just an average, whereas the two ends of the scale tend to be less conspicuous.

Professor E. G. R. TAYLOR: I have one or two questions to ask. The first one has not yet come up because Mr. Wallis has not spoken, or rather it has only come up partially, and that is in respect of the isopleth method spoken of by Professor Fawcett. We were told that it was on the analogy of drawing contour lines, but it seems to me there is a fallacy there. If we have a spot height of 250 feet and a spot height of 350 feet we can say for certain there must be a height of 300 feet in between. But do we know for certain that if there is here a density of 250 per square mile and there a density of 350, there must be in between a density of 300 per square mile? I understand Mr. Hinks had something to do with drawing those maps and, as he is a mathematician, perhaps he will be able to resolve my difficulty.

The second point, again a minor point, was in respect of some maps that Brigadier Winterbotham has prepared and which were printed in *Geography* a few months ago. There, by a curious optical illusion, the scale which is correct if you count the dots—that is to say the shades should get less and less dense—is not correct to the eye. The same point arises from what Professor Fleure said as to one of a system of graded colours standing out very vigorously, although only representing the intermediate population figure. I should like to ask Brigadier Winterbotham whether he would consider rather sacrificing the correct number of dots in order to get the correct visual impression. And again, has he considered whether certain colours, although they seem to be correctly graded from the point of view of the spectrum, are not correctly graded according to the eye?

It would seem from what we have heard this afternoon that both the dot

and the shade population maps can really only give a general visual impression. We cannot expect from them accuracy. It seems a real fault of the dot method that it leads the unwary reader of the map into error. He thinks the dots have been so carefully placed here or there, but, as a matter of fact, the drawer of the map knows perfectly well that when he uses a dot to represent 25,000 people and decides to put a dot in a certain place, there are not in fact 25,000 people just there. And yet he does not say so. So there is a pseudo-accuracy about these dotted maps.

Brigadier WINTERBOTHAM: I entirely agree with every word Professor Taylor has said. I do not think that the accuracy of the system must for a moment prevent us from getting the proper sequence to the eye, because I am sure that is the more important thing. I realize that I made a mistake in those maps in *Geography*.

Mr. B. C. WALLIS: It is like going back many years to come and talk about population maps and the work we did under Mr. Hinks' initiative and guidance something like fifteen to twenty years ago. My earlier work in connection with the Midlands of England was done some years before the work I did in connection with maps of Austria and Hungary. The density of population map was always secondary to the main purpose of the investigation.

Professor Fawcett showed a slide of one of the Hungarian maps we made. That map by itself has nothing to do with density of population at all. It is an abstraction of an abstraction. It was merely a map of the Census of nationalities or races in the areas. By itself it was not very informative except for one purpose, and that was the purpose for which we made it: to find out if there were definite dividing lines between these races and, if they were definite, how definite they were; if it were possible to draw a very thin black line on the map and say on one side there are Magyars and on the other side Slovaks. The piece you saw was one of the most difficult of the whole of the areas included in the investigation, but it was only a percentage of a density map, and the percentage of density requires a calculation of people per square mile. We made density maps on the contour method, for speed. It gave us the information we wanted, but we do not pretend for a moment that the contour, or isopleth, method has the same accuracy of content, the same density of stuff, as it were, behind it. We do not pretend that our shades of colours represent a continuous mass of people piled one upon the other, or standing side by side, as you would expect when you see hill slopes and valleys. It cannot be that. It is merely an indication, so far as the Census information goes in the units in which that information is to be calculated and enumerated, that if the density is over 250 per square mile that area will be this side of the line shaded dark red, and if it is under 250 per square mile, *i.e.* a less densely peopled place, it will be on the other side of the line. Of course it is only a summary of information which requires other things behind it, as all maps do. We did not pretend that it was anything else but what it set out to be—a quick investigation rapidly made for a specific practical purpose.

The PRESIDENT: I will call upon Mr. O'Dell, who is one of Professor Taylor's staff at Birkbeck College, and who has already been making some experiments on estimation of densities on spot maps.

Mr. ANDREW C. O'DELL: The publication of official statistics of popula-

tion dates back for fourteen decades in this country, and although since the inauguration of the census the material has been thoroughly sifted, by sociologists in particular, Britain lags behind in one of the most vital exploitations of the material, namely, the cartographic representation of the data. While the 1851 Census Reports (Population Tables, vol. I) reproduced maps by Augustus Petermann utilizing the stipple shade intensity as approximately proportional to the population density there had been at least one precursor. The Second Report of the Railway Commissioners for Ireland has an atlas volume containing a map by Henry D. Harness, Royal Engineers, which uses the same technique as the 1851 Census Report. In a crude form it has the germ of the fundamental principle of the recent Ordnance Survey publications, namely density zones which cut across the administrative units; but Harness' map fails to reach the standard of the recent layer maps since the towns have circles which are proportional to the population figures of the 1831 Census. The actual urban population figures are superimposed near the towns while for the rural areas the density figures are scattered over the stipples in the manner of geological symbols, *e.g.* 215, 220, 250, and 270 persons per square mile. It is a matter of regret that the realization of the virtues of cartographic representation was apparently forgotten in this country until nearly a hundred years later. Other countries of such widely differing magnitudes as Holland and the United States publish detailed maps not only of the prime facts of total population but of such distributions as those of religions and of occupations. One feels that if the Census authorities and the Treasury could be persuaded of the public utility of such maps it would be possible to see within a reasonable period an adequate representation of these islands from the aspect of the economic and social structure.

Meanwhile such a discussion as this serves to clarify the situation and will help to unify research technique and later, let us hope, the routine production by official bodies. As Professor Fawcett has shown, the field lies between the dot map and the coloured map with a possible combination of the two. The dot map in its utmost form of precision, viz. the dot representing one inhabited building, was, I believe, first used in a study of the Shetland Islands (*Geogr. J.*, June 1933, vol. 81, pp. 508, 512). Precise, since the site of the building is a fixed point, it shows critical distributions which can be readily correlated with geographical controls and is therefore useful for the research worker. If one dot represents too big a figure it is useless for the correlation of rural distributions, even if the greatest care is taken in the selection of the centre of gravity; while, if the dots have too low a value they run together in the urban areas and the resulting "black out" is both unsightly and useless. As regards a map with a suitably chosen value per dot I have experimented on lines suggested by Mr. Hinks. While I did not go as far as he wished, I think the reactions of nearly a hundred Birkbeck College students, all undergraduates familiar with the use of dot maps but not all experienced in their construction, have been illuminating. They were asked to fill up a schedule stating their optical impression of the density of dots in the circle B to L taking circle A as unit density. As the second diagram shows, they often failed to differentiate circles G, E, and K, which are twelve, fourteen, and sixteen times the density

of A; and they also, with a low percentage of exceptions, considerably underestimated, rather than over-estimated, all the densities save that of C, which was only twice that of A. The greatest density was F, which, while actually thirty-six times that of A, was never judged to be more than twenty-four times, and that by only two students. This test, simple as it is, with the ignoring of change of dot size, seems to cut away the most commonly stated merit of dot maps—that, while not of use for examining individual dots it shows a true picture of the relative density of the placing and hence, in the present discussion, the population distribution. Add to this the common concomitant of dot mapping, careful selection of the centre of gravity, and also the attempts to compare areas of all shapes and sizes some of which are surrounded by expanses of white paper and others by masses of dots, and it will be seen that the optical impression is still further from the actual distribution.

I feel that for all save research maps the layer map is the most fruitful method despite the fact that density is a more abstract concept than the distribution on the earth's surface. While some workers hold that the scale of density zones for shading should be uniform on all maps, *i.e.* the mean of critical densities over large areas or by a logarithmic progression, it seems to me that unless the map is part of an international scheme the scale should be chosen, as in the forthcoming $\frac{1}{2}$-inch map of London, after a careful examination of the densities of the area to be mapped, and so chosen as both to avoid unduly large areas of the same tint and at the same time to get density zones which mean something on the ground, *e.g.* a density zone which can be typified by, say, the recent building of suburban villas in Lower Streatham. In order to cut up the artificial administrative boundaries it is essential to have detailed maps closely contemporaneous with the date of the Census—particularly where the population changes rapidly as in the London Transport area.

As well as the static population distribution it is apparent that the moving of population through time is of greater importance to the historical geographer and the sociologist. The following two slides and film show a research worker's attempt to tackle the problem by maps and diagrams. Population migration by the return of place of birth can be shown by arrows to or from an area where the width of the arrow is proportional to the number of people concerned. If it is required to show changes over several decades then the readiest solution seems to lie in superimposed graphs on the areas of origin or destination. The diagram of the distribution of people of Aberdeenshire birth from 1861 to 1931 shows the clarity and effectiveness of the technique. If the changes within an area are considered it is found in the same way that the superimposed graph is a ready approach. In the particular example chosen Aberdeen is left out on account of the large figures in contrast to those showing the rural character of the county from 1696 to 1931. A few of the parishes had boundary changes and it is important to note that the graph fails to take cognizance of the change whereas the density of the parishes, decade by decade, does. Thus if the area is taken into account it is possible to eliminate the boundary changes if the density at the period of the census is calculated, but obviously if the change of density is calculated taking the previous census as unity then the boundary changes are an unmitigated nuisance. The late

Captain Withycombe suggested to me a combination of the population change expressed in relation to area in order to reduce largely the artificial percentage difference between an urban and a rural area resultant in an equal increase of population. This seems suggestive of important modifications of cartographic mapping principles leading to maps reflecting rather the importance of the change than an artificial percentage which ignores area.

Recent work on the technique suggested filming as a means of escape from the difficulties. The dot method being rejected, seventeen maps were constructed, using the Ordnance Survey 1/1M scale of zones, for Aberdeenshire for 1696, 1755, *circa* 1793, and 1801–1931. While useful in eliminating the sixteen pauses in showing seventeen slides it fails to give a picture of progressive changes. Four thousand maps would be required for the elimination of the jerks in this short film and since a "jerk" would take place every time a parish moved from one zone to another interpolation for inter-censal years would fail to give a smooth-running picture. As well as the parish densities the barb beside the scale gives the average for the county while railways and the solitary canal are shown by dotted and pecked lines respectively for the years in which they were open. I show this film then not so much as a way of showing dynamic changes of population but as an attempt which, while failing to reach the ideal, may lead others to a successful solution of a difficult problem.

The PRESIDENT: We thank Mr. O'Dell very much for the immense pains he has taken to give us that lucid explanation of his own idea. I will now invite our Secretary, Mr. Hinks, to whom Mr. O'Dell referred, to make some comments, if he will.

Mr. HINKS: It seems to me that no population map or population-density map which does not enable one to take off some figures from it, without elaborate calculation, can be considered as anything of a success; and the question of taking off figures involves the difficulty that the figures of the population run up so steeply: there are enormous densities of population and then there are sudden differences in density, which immediately suggest to any one who has had anything to do with similar problems of representation and distribution on the celestial sphere that one often can use with advantage a logarithmic scale instead of the ordinary arithmetical scale for the population, or population-density. The great convenience of the logarithmic scale is that instead of a scale of 10, 100, 1000, 10,000, and 100,000 you have a scale of 1, 2, 3, 4, 5. The logarithmic scale is perfectly suitable for dealing with changes of density of that kind, and I commend it to the use of those who are making experiments with these density maps. If it is maintained that some people cannot understand what a logarithm is, they must just be given a little table and learn to look upon it as an arbitrary but useful device.

Professor Taylor asked whether there was any difference between the contour of a topographical map and the contour of a density map. I do not think there is. Each of them depends upon having, in some way or other, sufficient knowledge of the heights above sea or the density of population over the area, enough to enable you to interpolate contours between them. Professor Taylor also asked if one can say with confidence that between a density of population of 250 and 350 there is one of 300. You cannot say exactly, but

neither can you if you are making a topographical map. You can say that there are two points of 250 and 350, but it does not follow that there is a 300 half-way between them. The whole point is that you must have a sufficiency of detailed information to map in either case. In making a topographical map you go about looking at country between spot heights and sketch in contours. To make a satisfactory population-density map you may do something of the same kind; but it seems to me that the evidence is all in favour of the contour map rather than the dotted map.

It has not been pointed out that the contour map, of which that prepared by the Ordnance Survey is an excellent illustration, need not necessarily involve layer-colour printing, which is a luxury. Professor Fawcett did not make clear, I think, the particular feature of Mr. Wallis' map, that it showed by interlacing coloured contours the percentages of different nationalities in a mixed population. When one is not showing mixtures of population, one needs only a single series of numbered contours that can be overprinted in one colour on any topographical map, without much obscuring the topography. That is both inexpensive and highly instructive.

I was very much interested in the experiment that Mr. O'Dell made after a conversation we had one day in my room here. I wish only that instead of making an artificial distribution he had taken a series of areas from an actual dot map, because Professor Taylor has pointed out a very important fact: that our estimate of density depends not only upon the number of dots but also upon their relation, whether in diagonal or horizontal lines; and whether or not those estimates are determined, in part at any rate, by whether the observer is or is not astigmatic is certainly a question worth examining. But I should prefer to see the experiment made from maps in which the dots are not arranged either in horizontal rows or in diagonal lines, but are a little uneven. You might then get more valuable results. At any rate, experiments upon the lines Mr. O'Dell has followed, but with actual maps, ought to be made by other people. It is singular that no one had so far made any attempt to estimate whether one can estimate densities at all accurately from these dot-maps. If they are to have anything more than a mere shading effect, then experiments such as Mr. O'Dell has made, and others will doubtless make, must be carried on to give some idea of their numerical value. But for my own part, if I had any money to put into one kind of map or the other, I would put it into maps showing contours and occasionally what we may call spot heights. With contours numbered on a logarithmic scale it is possible to deal with all parts of a country where the population grades are more or less easy. When you suddenly come into a great aggregation of population like Glasgow with beautiful open country only a few miles from the City, no shading or contouring will do much good. You must put down a sort of population spot-height, and instead of writing it in millions or thousands I should write it as a logarithm to one or two places of decimals.

Professor Fawcett then read the following note from Mr. AUROUSSEAU:

There are two schemes of representation to which Professor Fawcett does not allude: Jefferson's symbols and the proportional square system. Jefferson is interested mainly in urbanism, but has so developed his symbols that their overlap shows at a glance those parts of a country which are regionally

urbanized. The Society, it seems, has no copy of his latest map of the United States, and I regret that I cannot supply the exact reference to it. Macdonald Holmes and John Andrews have used the proportional square system in their 'Descriptive Geography for Secondary Schools, Part I' (Sydney, 1933). The method is described by Catherine D. J. Back ("The Construction and Interpretation of Statistical Maps"), in *The Australian Geographer*, vol. 2 (1933), pp. 29–37. It shows the concentration of the population of Australia in the capital cities very well.

I attended a discussion on population maps in New York in 1921, when Ellsworth Huntington maintained that the only satisfactory means of representation was the isopleth. The American Geographical Society of New York then attempted to prepare population maps for areas covered by its 1/M Map of Hispanic America, but found the method very difficult in exact application. The first purpose of a population map being to show *where* the people are at a given time, it seems to me that more use could be made of the distribution of buildings and of built-up areas, as shown on the 6-inch O.S. maps. Some sort of foundation could thus be provided for the next step of showing how many people there are in particular areas. A discussion of this kind can hardly lead to the development of any standard method of mapping population, because of the different purposes for which maps are required. It may however be possible to define the main purposes, and to decide what methods of representation are most suitable in given cases. Batschelet's map of Pennsylvania, to which Professor Fawcett refers, is the result of many trials. He found by experiment that dots of a certain size, each representing a certain number, distributed themselves in such a way as to represent the distribution of population in Pennsylvania, on the final scale of reproduction, better than any other combination. It would seem then that there are critical values for dots.

The PRESIDENT: It is getting late so I think we must conclude the discussion. As a non-scientific geographer I am afraid I find it difficult to size up very clearly the situation as to which method of showing density of population is most favoured by those who have discussed the subject. Moreover it seems to me that in considering the question one must choose one of two points of view: either that of the casual user of the map who wants to get a general impression from a cursory glance, in which case either the colour or the dot method seems to me equally useful; or, on the other hand, that of one who wants really to study the density question. For him the contour system seems just as good, and, as speakers have explained, it is a much simpler and more economic use of the Ordnance Map. It seems to me it is necessary to decide which point of view you have in mind before a final opinion can be expressed.

It has been extremely interesting and useful to hear the different views of those with special knowledge, and I hope that at all events the discussion will have thrown some useful light on the subject and help those most interested to go on working at it with a view to arriving at a solution which will commend itself to the majority. Before we close I will ask Professor Fawcett to make a few comments on what has been said in the course of the discussion.

Professor FAWCETT: I think the discussion has been well worth while.

But it is much too late, and it would take too long, to refer to all the matters that have been raised.

I should like to go back to the first points I tried to make in the paper: that one may attempt to represent either density of population or numbers and arrangement of the population, and that the scales concerned seem to me to be an important fact in deciding which is the best method. For very large-scale maps such as that of Manchester, the dot method can show the distribution with an accuracy which it is quite impossible to obtain by any general shading. For maps on intermediate scales there is much to be said on both sides. I am inclined to think that the choice of method should depend mainly on the purpose for which the map was intended, rather than on the general impression. As to the general effect or impression: it is of course obvious, as I suggested in showing the map of China, that in a very small-scale map of a large area such as that the dot method produces on the eye an effect which is just that of shading. The only difference between a general shading and what is called by some of its supporters the "absolute method," *i.e.* the method by which each dot has a particular value, is that from the latter you can count the number of people within any definite areas. Whether that is of sufficient value to determine which method of shading shall be used is obviously a question to be decided mainly by the purpose for which the map is made. It seems to me to be a very valuable addition to the map.

The kind of work done and the interest shown by those who have taken part in it is, I think, a very thorough justification for this discussion itself. I should like to thank all those who have contributed. It is quite impossible to particularize. I find in my notes of reference far too many names for me even to mention all. But among those who have not been able to be present I should like to thank in particular Dr. Alfred Söderlund, of Stockholm; Dr. Guy-Harold Smith, of Ohio; Professor August Tammekann, of Tartu; and Dr. J. G. Granö, of Turku, who have helped by their maps and written contributions; and to acknowledge the inspiration of the late Professor Baron Sten de Geer, to whose initiative much of the work on population maps is due, and whose untimely death is so great a loss to the study of Human Geography.

The PRESIDENT: It remains to thank Professor Fawcett very much indeed for coming here and opening this discussion. That concludes the business for the afternoon.

Dr. GUY-HAROLD SMITH *has sent as a contribution to the discussion the following Memoranda on the Construction of the Population Maps of Ohio and Wisconsin, photostat reproductions of which he has presented to the Map Room of our Society:*

The legends on the maps are self explanatory, though all matters of importance are not treated. The photostat reproductions are on a scale of approximately 1 : 1,000,000; the original maps were drawn on a scale of 1 : 500,000. As stated on the maps each dot represents twenty-five inhabitants localized by minor civil divisions. In the case of Ohio, the minor civil divisions are townships which contain, where the rectangular survey was used, 36 square miles. In a large area in the central part of the state, known as the Virginia Military District, the townships are irregular but the sizes do not differ

greatly from the regular government survey. To assist in the localization of the dots a township map was placed under the original tracing. The boundaries on the finished map represent only the counties. This precision in the localization of the dots makes it possible to show quite accurately the thinly populated and the densely occupied areas. The villages and cities are shown by sphere-like symbols similar to the system devised by Sten de Geer. I think this statement needs very little amplification. The sphere-like symbols were drawn in the following manner. First, all the cities and villages were listed and the cube root of their population determined by use of a slide rule. These numbers were scaled down to convenient values which were used as the radii of the circles, each centred upon the appropriate urban unit on the map. After the circles were all drawn they were shaded free-hand to look like spheres. Note the grouping of the suburbs about the major cities such as Cleveland, Cincinnati, and Columbus. In the preparation of the Ohio series the 1920 map was drawn first. A few years later I drew the 1930 map, and this summer the State Planning Board of Ohio asked me to prepare the 1880 and the 1900 maps.

The Wisconsin series was prepared in the same manner as the Ohio maps with one or two important exceptions. The dots, one for every twenty-five inhabitants, were localized by civil townships. This careful localization of the dots required many months of research to portray accurately the distribution of the people. The cities are represented by circles, the areas of which are proportional to the population. While this device is not so graphic as the spherical symbol it has its merits. Perhaps relative values can be more easily estimated. Furthermore, it can be drawn as a transparent disc making it possible to show the corporate limits of the cities. Also where the circle extends beyond the city borders the rural inhabitants and the suburban centres can be represented by their appropriate symbols. The Wisconsin maps are being used by the State Planning Board. They have superposed the railway map on the population maps and the effect is very graphic. In their general studies involving the use of the land and the redistribution of the inhabitants these maps are always before them. I regret that I have never had time to draw the 1890 and 1910 maps, and thus complete the series. The first six maps were originally published in the *Geographical Review* for July 1928. A brief regional paper was written to accompany the maps.

The following notes, together with the map which they describe, have been received from Professor AUGUST TAMMEKANN, *Professor of Geography at Tartu University, and are here printed as a contribution to the discussion:*

The present map of the distribution of population in Estonia (scale 1 : 200,000) is based on the data of the Second Estonian General Census arranged in 1934. It is, in general, based on similar material and arranged according to the same cartographic principles as the map of the distribution of population of 1922 constructed by me before.[1] In both cases I chose the so-called absolute cartographic method of presentation. This method, extensively used and popularized by Professor Sten de Geer, is well known.

[1] A. Tammekann, "Outlines of the Distribution of Population in Estonia." *Publ. Inst. Univ. Tartuensis Geogr.*, No. 16, Tartu 1929.

The advantage of an absolute population map is, in my opinion, that the absolute amount of population in any defined area may be read off the map, and one need not be satisfied with the figures for administrative units, which generally are given in the summaries of statistical offices. Thus, an absolute map of population can be a good and useful basis for different relative cartographic presentations. It must however be kept in mind that the scale of the map, the density of population, and the value and size of a dot should be in such a proportion as to give cartographically good and readable results. Below follow some supplementary remarks concerning the statistical and cartographic materials of the census of 1934.

Statistical materials.—For the census the whole country was divided into 12 districts (Tallinn and 11 provinces), which were subdivided into subdistricts (towns, boroughs, and 375 parish-subdistricts), and these parish-subdistricts consisted of about 12,000 census units, the latter representing regions where the census was arranged by one person. The number of census units in one parish ranged from 1 (Ruhnu, 282 inhabitants) to 132 (the parish of Senno with its 8720 inhabitants being the most densely populated parish of Estonia). The amount of population in one district was mostly about 40–70. In 1934, as in 1922, the inspectors of districts had already before the census submitted lists of houses of their districts, *i.e.* parish, borough, or town, together with corresponding numerations of the houses and with schemes for dividing their districts into census units, pointing out which houses belonged to each unit. To the lists of houses there were now added maps of a larger scale, 1 : 42,000 (in 1922 1 : 126,000), in which the numbers of houses and the boundaries of census units had to be indicated. Not all of the maps however had been provided to the same extent with the required data and not all of them were returned to the Chief Statistical Office. The country population, *i.e.* the numbers of the inhabitants of villages and market towns, I transferred from the control-forms to the schemes for the corresponding districts, these schemes forming the basis for denoting the distribution of population in a map. The total amount of each district however is taken from the summaries of the Chief Statistical Office and the figures of the control-forms are corrected correspondingly. Differences in figures are possible within limits of 1–3 and are therefore not of value in a cartographic presentation. The figures for towns and boroughs were directly taken from the summaries of the Chief Statistical Office.

Cartographic material.—As a basis for the placing of dots denoting the population I used, above all, the above-mentioned district maps 1 : 42,000. These however were not all complete to the same degree and were wanting for one part of the districts. To fill the gaps ordinary topographic maps 1 : 42,000 had to be used. But these maps are antiquated, especially with regard to settlements, and therefore it was not possible to place the dots with strict accuracy. The general aspect of the distribution of population is however not much influenced by that. As outlines for the map to be constructed I used copies of the outlines of my Estonian map 1 : 200,000, in which on the whole the centres of settlements were already marked.

The value, size, and method of placing of the population dots.—The map was constructed according to the principles of the so-called spherical absolute

method of cartographic presentation. For the value of a dot I chose, as I had also done for my former map and for the same reasons, fifty persons. The various groups of dots denote the whole distributed country population, *i.e.* the population of the farms and the mixed (half rural, half urban) population of the market-towns belonging to the parishes. Towns, boroughs, and larger industrial centres in the country are denoted by spheres in due proportion to the dots. All the spheres together denote 348,000 inhabitants, or 31 per cent. of the whole population of Estonia. The remaining 765,000 country inhabitants are symbolized as 15,300 dots, the value of a dot being fifty persons. The dots were distributed in the same way as in my former map. Differences which, in this respect, arise between the former and the present map are caused, on the one hand, by the shiftings of the population and the general decrease of the country population, and, on the other hand, by the fact that in the present case I had at my disposal district maps which were more accurate and of a larger scale.

Providing an absolute population map with supplementary data.—A population map constructed according to the absolute method of presentation, seems perhaps to be somewhat empty. A map of the distribution of population can however be provided with supplementary information, which makes it possible to draw conclusions concerning the circumstances influencing the distribution of population. Thus, beside the population dots colours or hatches can be used to denote either districts with different densities of population (as in Sten de Geer's map of the distribution of population in Sweden) or vegetation, especially cultivated land (as in J. G. Granö's map). The relative density of population can be derived from the absolute dots by using an exact method, the until now little-known and rarely-used method of the Swedish cartographer Backhoff. From an absolute map it follows that the smaller the relative density of population the larger are the distances between the single dots and *vice versa*. This relation can be expressed mathematically; spaces with equal relative density in the map may be systematically found out and denoted by different shades of colour or hatches. A relative map constructed according to this method corresponds to its basis, the absolute dot map, as, for instance, a more or less generalized pen-and-ink drawing corresponds to a photograph. The distribution of cultivated land can be indicated in two different ways. Either we mark in the map the real areas of cultivated land duly generalized, or we denote them quantitatively, as coloured squares. Hitherto I have seen only quantitative maps of cultivated land[1] with no indication of the distribution of population, but it would be quite possible and very instructive to indicate both phenomena in the same map. Such a map would give us two sets of quantitative data together, *i.e.* the amount of population and the area of cultivated land, showing also the distribution of these values. From the relations of these values different relative values can be quite exactly derived, *e.g.* the density of population in proportion to cultivated land, etc. Thus an absolute population map becomes a most necessary resource for solving different anthropo-geographical and economic problems, *e.g.* the distribution of population, the density of population, over-population, etc.

[1] H. Laasi, "Die Verbreitung des Acterlandes in Estland." *Publ. Inst. Univ. Tartuensis Geogr.*, No. 20, Tartu 1933.

THE ENTRENCHED MEANDERS OF THE HEREFORDSHIRE WYE

A. AUSTIN MILLER

THE object of this paper is to elucidate the stages in the physiographic evolution of the Wye Valley below Hereford and of the plateau of the Forest of Dean through which the river meanders in a deeply entrenched valley. While these incised meanders supply perhaps the best examples of this land-form in the country, they have never, so far as I have been able to ascertain, been accorded detailed attention. It will be shown that while the essential facts are simple enough there are considerable complications in detail, and that the river has passed through a very varied history since the inauguration of the meanders.

The Forest of Dean is a clearly defined highland region with a plateau-like surface 600 or 700 feet above sea-level, but rising in places above 900 feet. It is separated from the Cotswold scarp by the Severn lowlands floored by Triassic rocks, and from the mountains of the South Wales coalfield by the Usk lowlands floored by Old Red Sandstone; yet it is precisely through the highest part of the intervening plateau that the River Wye has cut its valley on its way to the Bristol Channel. Such behaviour calls for an explanation, which is only to be found by an investigation of the earlier phases of the river's history before the Severn and Usk lowlands came into existence. The subsequent history is preserved, somewhat fragmentarily, in the meanders acquired during an earlier senile stage in the river's evolution, preserved deeply entrenched in the rejuvenated river valley.

In the first half of this paper the relevant features of the relief are described, and in the latter half an attempt is made to explain these features, and, by adducing them as evidence, to present a consecutive account of the physiographic evolution of the region.

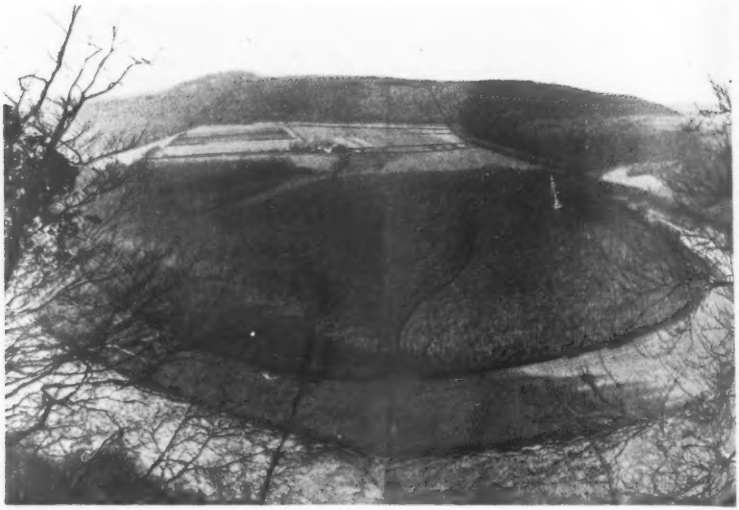
Geological structure and relationships of the Forest of Dean

The Forest of Dean is a replica in miniature of the South Wales coalfield, a structural basin lying near the intersection of the Armorican (east–west) and Malvernian (north–south) folds of late Carboniferous age. In the South Wales coalfield, an oval with its long axis from east to west, the Armorican trend prevails, but in the Forest of Dean, lying farther to the east and nearer the line of the most active Malvernian folding, the Malvernian trend is dominant and the basin is elongated from north to south. As in the South Wales coalfield the resultant relief is that of a highland area of Carboniferous rocks, coal-bearing in the upper layers, buttressed by the upturned edges of the lower Carboniferous limestone and embedded in the Old Red Sandstone of the plain of Hereford. The Coal Measures which form the centre of the basin extend over a distance of 10 miles from Ruardean in the north to New Mills in the south, and over $6\frac{1}{2}$ miles from Cinderford in the east to Coleford in the west (see Figs. 1*a* and 1*b*). They are clad nearly everywhere with dense oak forest, the ancient royal Forest of Dean, almost hiding the collieries, which occupy clearings surrounded by fine trees and enjoy a

1. Forest of Dean plateau falling steeply to the Wye; Staunton Meend (915 feet) in centre background

2. Garren Brook Valley above Marstow, lying between 250 foot platforms in foreground and middle distance; Forest of Dean plateau in background

3. Looking "upstream" from Frogmore towards Weston-under-Penyard in the dry floor of the abandoned meander course



4. Looking across the Wye from Dennel Hill to Liveoaks Farm on a spur bevelled at 250 feet; Wyndcliff Hill (771 feet) in the background

5. Ceciliford, an ancient valley on the Forest of Dean plateau, 3 miles north-west of Tintern: wide, flat, and swampy

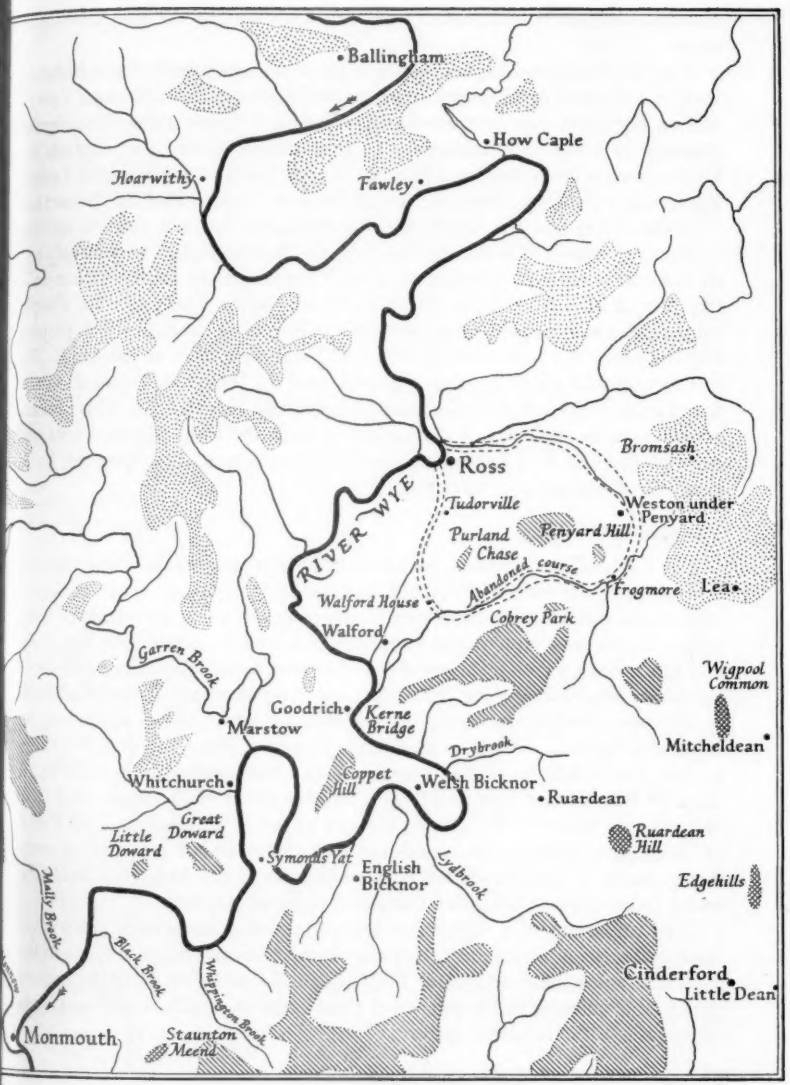


Fig. 1a. River Wye from Ballingham to Monmouth

situation pleasantly contrasted with the drab setting of coal mines elsewhere.

The Drybrook Sandstone, which is the local equivalent of the Millstone Grit, is concealed on the north between the Drybrook and Lydbrook Valleys, and on the south-east between Lydney Park and Staple Edge Wood by the overstep of the Coal Measures (1). This same overstep also conceals the Carboniferous limestone for a distance of 3 miles to the north-east of Lydney Park, where the Coal Measures actually rest on the Old Red Sandstone; but with this exception the Carboniferous limestone forms a continuous ring round the coalfield. On the eastern flank the limestone dips very steeply and its outcrop is narrow, forming the abrupt border of the Forest with a wall-like line of hills from Little Dean to Mitcheldean. The rocks are sharply folded into a southward pitching syncline at Wigpool Common which projects like the prow of a boat into the Old Red Sandstone plain to the north. But in the west and south the dip is gentler and the limestone forms a plateau 2 or 3 miles wide, well seen between Coleford and Hewelsfield. This plateau, centring on St. Briavels, is distinguished from the Coal Measure area and most of the Old Red Sandstone outcrop in being much less forested, being generally grassland or cultivation.

The plain of Hereford

The Carboniferous basin is embedded in the great expanse of the Old Red Sandstone of the plain of Hereford, but the uniform colour of the geological map masks considerable variations in composition; there are bands of limestone (Cornstone) and quartz conglomerate, interstratified with the marls and sandstones, which form prominent features, sometimes rising well above 1000 feet, as in Skirrid Fawr (1601 feet) near Abergavenny. From Monmouth to Newport, west of the River Wye, it forms a high plateau which may be called the Trelleck plateau, at an average height of about 800 feet, but rising to 1003 feet in Beacon Hill and terminating south-westwards in the wooded ridge of Went Wood (989 feet). The Silurian inlier of Woolhope and May Hill extends for some 16 miles on the east of the Wye Valley and the Forest of Dean, and includes the limestones and shales which form the inward-facing scarps of the denuded Woolhope dome and the May Hill Sandstone which forms the wooded hill of that name rising to 969 feet.

Thus the lower Wye Valley and the surrounding lands comprise a great variety of rocks of very varying degrees of resistance to erosion. These in the main determine the distribution of highland and lowland, but certain features of the relief show an independence of these controls which is explicable only by analysis of the erosional history.

The summit levels of the Forest of Dean

The highest hills within the area show a very close agreement in level, rising to 900 or 1000 feet and no higher. In the Forest of Dean itself Wigpool Common (914 feet), Ruardean Hill (932 feet), Edgehills (920 feet), and Staunton Meend (915 feet) may be mentioned, while on the Trelleck Plateau are Beacon Hill (1003 feet), Broad Meend (906 feet), Chepstow Park Wood (936 feet), and Wentwood (989 feet); just beyond the north-eastern boundary

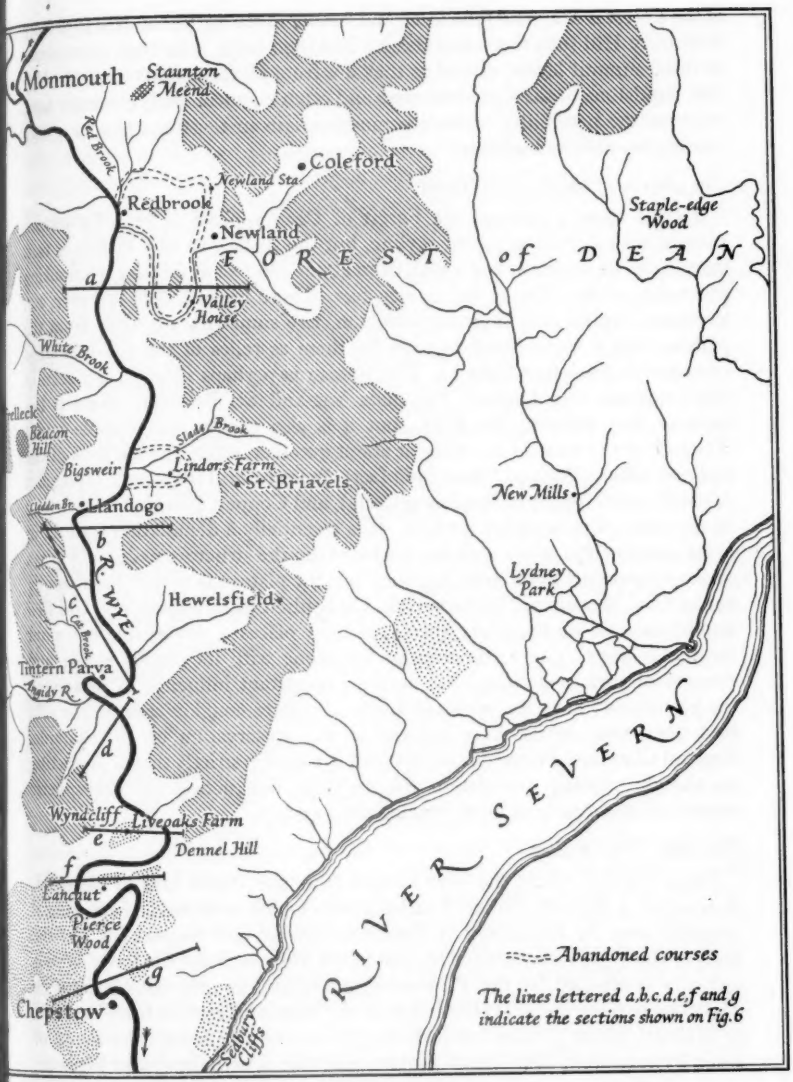


Fig. 1b. River Wye from Monmouth to Chepstow

of the Forest is May Hill (969 feet), and farther north are Orcop Hill (958 feet), Aconbury Hill (965 feet), and Seager Hill (892 feet). The close coincidence of these summit levels, carved as they are from all formations from the May Hill Sandstone to the Coal Measures and often characterized by tabular tops, suggests the possibility of their common origin in the dissection of a once continuous planated surface.

The plateau of the Forest of Dean

Viewed from a distance the Forest of Dean appears to be a flat-topped plateau with a strikingly even skyline, but the surface is, as a matter of fact, very irregular in detail, and varies from about 500 feet at its edge overlooking the valley of the Wye to 800 or 900 feet. These highest hills however, *e.g.* Staunton Meend and Wigpool Common, rise somewhat abruptly from the plateau, and I am inclined to consider them as relics of the 900-foot stage mentioned above (see Plate 1). The plateau is perhaps most clearly seen in the limestone area between Symonds Yat and St. Briavels, where it lies between 600 and 700 feet O.D., but it is also clearly recognizable round Trelleck to the west of the river at about 700 feet, while the flat tops of the isolated hills of Purland Chase (666 feet), Penyard Hill (660 feet), Great and Little Doward (661–710 feet respectively), and Coppett Hill (651 feet) belong to the same physiographic horizon. It is essentially a denudation feature; in areas composed of strata with low angles of dip the structure necessarily plays an important part in influencing relief, but the plateau is carved indifferently across Coal Measures, Millstone Grit, Carboniferous limestone, and Old Red Sandstone, and its boundary shows in many places a remarkable contempt for the geology. The Carboniferous limestone with its porous nature and poverty of surface drainage has been an important influence in preserving the plateau; so have the resistant layers of quartz conglomerate in the Old Red Sandstone, which have assisted in the preservation of, for example, Purland Chase and Penyard Hill, but their function is strictly that of protecting an already existing denudation feature from destruction by atmospheric agents and the attacks of a rejuvenated river system.

The lower Wye Valley

From Witney, where the Wye escapes from the Welsh hills to Hereford, it occupies a drift-encumbered valley across which well-marked recessional moraines may be recognized at Staunton-on-Wye and Sugwas (2), but the limit of the Wye Valley glacier lay just below Hereford and the lower Wye is virtually unaffected by the Pleistocene glaciation. It may conveniently be described in three parts: (1) the course in the Plain of Hereford from Hereford to Walford, about 3 miles below Ross; (2) the course through the Forest of Dean Plateau from Walford to Tintern (the tide is actually felt at Bigsweir, 3 miles farther upstream); and (3) the tidal portion from Tintern to the mouth.

(1) *The River Wye from Hereford to Walford*

The 150-foot contour crosses the river just below Hereford and the 100-foot contour at Ross; the distance by water between these two points is 25 miles, giving a fall of 2 feet per mile. The river winds freely to Ballingham Ferry, but here enters on a remarkable double entrenched meander past Ballingham,

Hoarwithy, Fawley, and How Caple to Ross. The meander cores rise to 431 feet on the Ballingham spur and 366 feet on the Fawley spur, and both are tunnelled by the Ross–Hereford railway which runs on the flood-plain level. Viewed from their crests these spurs can be seen to form part of a gently undulating plateau which rises gently away from the river on either side of the valley to about 450 feet at the foot of the hills, which rise somewhat abruptly above the general level of the plateau. Into this surface, which may be regarded as an earlier valley floor, the river is entrenched some 250 feet. The most extensive relics of this surface are preserved around and above Ross; its approximate limits are shown on Fig. 1*a*. Around Lea and Bromsash (3 miles east of Ross) it forms a clearly defined step at about 350 feet, the land rising abruptly to the Forest of Dean peneplane on Penyard Hill; the railway and the main road from Mitcheldean to Ross follow its southern edge. The triangle of land between the Wye and Garren Brook which joins the Wye near Whitchurch is also made up almost entirely of this platform, and the Garren Brook and other streams have, like the Wye itself, become deeply entrenched into it in grading their courses to the River Wye of the present day (Plate 2).

For 2 miles above Ross and for 4 miles below that town the river, though winding, has no free sweeping meanders of the kind described between Ballingham and How Caple, but there are relics of a deserted one of a comparable magnitude. Penyard Hill and Chase Wood are northern outposts of the Forest of Dean separated from it by a deep, narrow winding valley with very steep sides and a flat floor occupied by an insignificant stream. Traced upstream to Frogmore the stream dwindles and disappears, but the valley continues as wide as before; the floor is flat and swampy and artificial ditches have been cut in it for drainage (see Plate 3). The course may then be traced upstream to Weston-under-Penyard with the railway on one slope and the main road on the other. From here the depression continues to Ross, drained by a very small stream, frequently aided by ditching. This was not however the complete original course of the meander, the neck would have been much too wide for severation by downstream encroachment. There is however a well-marked depression, followed by the railway from Ross southwards to Walford, whose highest point at Tudorville is just above 200 feet O.D., and therefore at the same height as the col between Weston-under-Penyard and Frogmore. The course of this meander was thus approximately that of the road from Ross, through Weston-under-Penyard, Frogmore, Cobrey Park, Walford House, and Tudorville back to Ross, which stands on the severed neck. The altitude of the meander floor is about 200 feet above the present river-level and the amplitude, about 3 miles, more closely resembles that of the meanders above Ross than that of the well-known series between Walford and Monmouth; but the significance of this is not clear at the moment.

(2) *The River Wye between Walford and Tintern*

From the point where the 100-foot contour crosses the river at Ross to the point where the 50-foot contour crosses at Monmouth is 20 miles by water, giving a fall of $2\frac{1}{2}$ feet per mile. From the 50-foot contour to the sea is about the same distance. The gradient of the river below Ross is thus steeper than

that above Ross in spite of the recent submergence of the river-mouth, but the difference is not very great.

At Kerne Bridge, just below Walford, the Wye plunges into the highland of the Forest of Dean and flows in a picturesque meandering gorge past the Bicknors, Welsh and English, to Symonds Yat, where it escapes again on to the plain (see Fig. 2). After forming the large horseshoe bend past Whitchurch it re-enters the hills and again occupies a deeply entrenched wooded valley to Monmouth, where it again escapes on to the plain and is joined by the Monnow. Almost immediately however it turns back into the hills from which it does not escape again until near Chepstow. From Monmouth to Tintern the course, though winding, does not swing in the wide sweeping

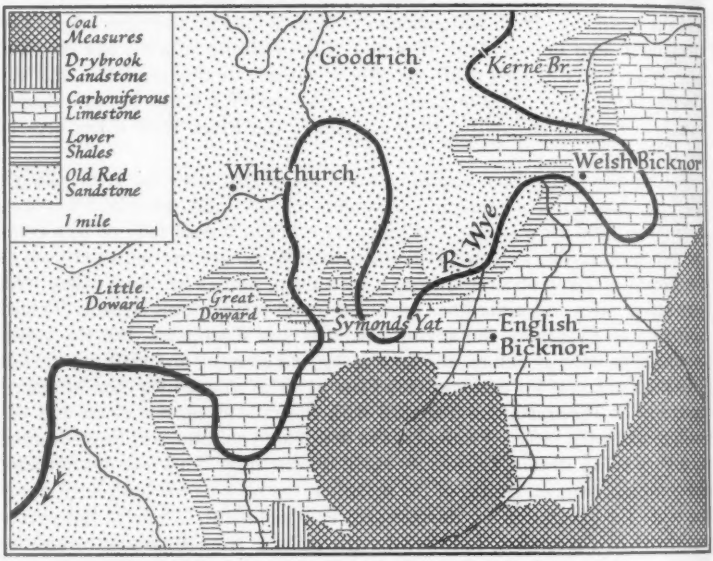


Fig. 2. River Wye between Goodrich and Little Doward

curves that characterize the course above Monmouth. But there is good evidence that two such meanders once existed but are now abandoned; they have been described by Dr. Morley Davies (3), and their course can be clearly followed on the 1-inch map. The upper one runs from Redbrook Mills by Newland Station to Newland and Valley House back to the Wye just south of Redbrook. The meander floor is at 418 feet O.D., *i.e.* about 370 feet above the present river, and it must have been abandoned at a much earlier stage than the Ross meander. Its neck must have been less than a mile across, and offers a close analogy to Symonds Yat, whose ultimate fate it foreshadows.

Three miles farther downstream the second incised cut-off forms the striking amphitheatre overlooked by the Castle of St. Briavels; Lindors Farm occupies the core of the meander. It is only slightly above present river-level, and its abandonment must have been very recent.

(3) *The River Wye from Tintern to the mouth*

The valley here shows signs of sharing in the comparatively recent submergence that has so enlarged the estuary of the Severn and the tide is able to penetrate as far as Bigsweir, about 3 miles above Tintern, so that the river at low tide is bordered by mud banks. There are several free meanders in this part of the course; the first, at Tintern, has a very narrow neck which must surely be severed before very long, geologically speaking. The cores of the next three meanders, Liveoaks Farm (Plate 4), Lancaut, and Pierce Wood, have flat tops at about 250 feet O.D. The Wye escapes from the highland at Liveoaks and the Wyndcliffe is the last outpost of the high plateau; a low plateau 250 to 300 feet above sea-level now borders the river on both banks and the three spurs quoted form part of this low plateau (see p. 172). The banks however still retain their steepness, and the gorge-like character of the valley is preserved although the gorge is diminished in depth.

The Tributary Valleys

With the exception of the Monnow no considerable tributaries enter the River Wye below Hereford. The lower Monnow, curiously enough, has carved a valley down the axis of a ridge of fairly high land that runs south-eastwards from Garway Hill and Graig Serrerthin towards Monmouth. Each slope of the valley therefore rises rather abruptly to a ridge at about 600 feet from which the land falls gently in the other direction to the plain. It should be noticed that the altitude of this ridge is about the same as the plateau of the Forest of Dean.

The tributaries that drain the Forest of Dean Plateau have certain characteristic features in common; they begin on the plateau as insignificant streams occupying open flat and marshy valleys (Plate 5), but on nearing the plateau edge the gradient increases rapidly and the streams become entrenched in steep-sided gorges entering the gorge of the Wye. Nothing could be more striking than the contrast between the impotent senility of the upper course and the vigorous youth of the lower portion. In some valleys (see p. 172 and Fig. 3) two changes of slope in the thalweg may be identified, the gradient in each case increasing downstream.

The coastal plateau between the mouths of the Wye and the Usk

Generally speaking the north bank of the Severn estuary, both above and below the confluence of the Wye, is flat and low-lying; sometimes, as in the Caldicot levels, the low land forms a strip as much as 3 miles wide. But behind the low-lying zone the land rises abruptly to hills having a height of about 150 feet. At Sedbury, 1 mile east of Chepstow, this hill zone actually forms the shore, rising in steep cliffs overlooking the estuary. Parkwall, Portskewett, Windmill, and Vinegar Hills, and Dockwell Wood (see Figs. 4 and 5) comprise this first line of hills, and it is recognizable east of the Wye confluence, as, for example, at Alvington (7 miles north-east of Chepstow), and at Hurst (1 mile east of Lydney). Their tops are generally flat, the margin of the flat top is well defined, and the slopes that lead up to the summits are quite steep. Behind them rise other plateau-like hills whose summits are slightly higher, the general elevation rising gradually inland to about 200 feet in Walt-

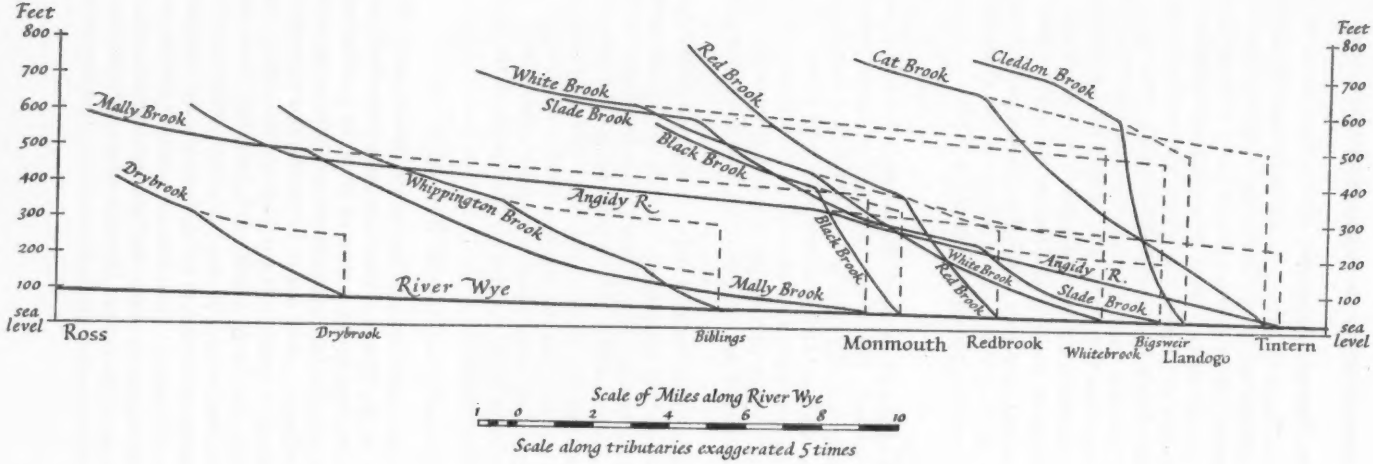


Fig. 3. Stream profiles: River Wye and tributaries

wood Hill, St. Brides Netherwent, and Slade Wood, and behind these again are still higher hills rising gradually to 350 or 400 feet in Chepstow Hill, Chapel Farm Hill, Daggers Hill, Cophill, and Piercefield Park, and in the long flat spur that runs from Itton Court to Piercefield Cliffs (see Fig. 6, *f*).

At this level however the flat-topped hills cease and the land rises abruptly to heights of 900 feet in the wooded hills of Wentwood and Chepstow Park. It is a striking fact that in the stretch of country between the Wye and the Usk, south of the Wentwood–Chepstow Park ridge, there are only six hilltops between 450 and 900 feet, and only two between sea-level and 150 feet, whereas between 150 feet and 450 feet there are thirty-eight. A further striking fact is the regularity with which the summits rise inland. In Fig. 4 the hilltops are plotted with their altitudes or, where the altitude is not given on the 1-inch map, the highest closed contour; contour lines have then been interpolated at 50-foot intervals between these spot heights. It will be seen that they are remarkably straight and show a marked parallelism with the present shore-line. The explanation of this will be given later (p. 176). Fig. 5 is a projected profile constructed in the manner described by Professor Barrel, and shows the hills rising one behind the other with steadily increasing altitude away from the sea.

The evolution of relief

The features described thus far cast light on the physiographic history of the river and the bordering lands; the succeeding part of the paper attempts to reconstruct the sequence of events in the light of the available evidence.

The uplift at the close of the Carboniferous initiated a prolonged episode of erosion during which thousands of feet of sediment were removed. By Triassic times an irregular surface had been produced on which patches of Triassic sands and breccias can be seen resting to-day. There are also fairly extensive outliers of Rhaetic and Liassic beds which, west of the Usk, form a continuous sheet of considerable extent in the Vale of Glamorgan. East of the Usk however Trias, Rhaetic, and Lias form only isolated patches, and they occur only on the southern and eastern slopes fringing the Bristol Channel, the most northerly outlier lying on Lancaut spur 2 miles north of Chepstow. These residual patches of mesozoic sediments are of great testimonial value, for their relationship, and especially that of the basal plane on which they rest, to the relics of the early peneplanes produced by the Wye, which are preserved in a more or less advanced stage of dissection on the high land of the Forest of Dean, affords valuable evidence of the age of the original plane on which the meanders were inaugurated. East of Chepstow and near Blakeney the base of the Lias has a very small dip indeed, and the inclination of the basal plane is totally insufficient to clear the high ground of the Forest of Dean; the Lias relics show only slight deformation, and there seems little room for doubt that the Forest of Dean existed as a highland region in Liassic times and that its margins only were submerged in what we might call the Proto-Bristol Channel of this period. The Triassic bears a similar relationship, and the way in which these deposits thin out and finally disappear against the Forest of Dean in the neighbourhood of Tintern, where the last outliers occur, makes it appear probable that the Trias also failed to bury the Forest. It used

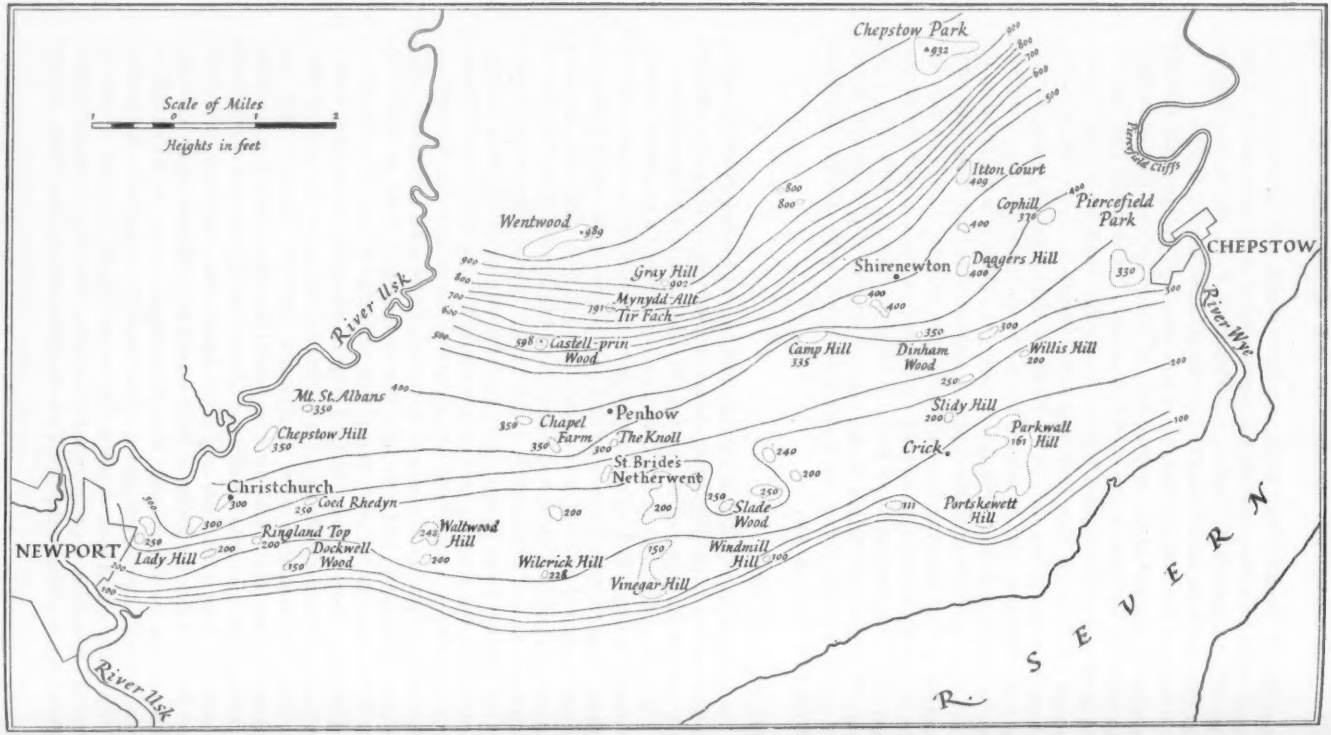


Fig. 4. Reconstructed extension of marine platforms

to be considered that the red colour of the limestones of the Forest and the well-known deposits of iron ore were derived from a Trias cover, but Professor O. T. Jones (4) has shown that this is neither necessary nor, in fact, likely. But although the evidence seems to show that the Forest of Dean remained a land surface throughout Liassic and Triassic times we must not lose sight of the possibility that the plateau existed at this time in a form not unlike that of to-day, and that it had been stripped of overlying deposits of a later period and re-exposed as a fossil peneplane. The somewhat similar plateau of the Mendips and other areas bordering on the Bristol Channel have this history, and their precipitous edges are fossil cliffs of Triassic age, at the foot of which screes (*e.g.* the Dolomitic Conglomerate) accumulated (5). But the Triassic was a "continental" period in British stratigraphical history, and it is generally agreed that the Trias accumulated under arid climatic conditions; these plateaux were therefore desert plateaux, probably irregular in form and varying in altitude; it is only where planation occurred during the subsequent Jurasic submergence that the surface is really level, as on the Mendips. It appears probable, then, that the Forest of Dean was not submerged in Triassic or Liassic times and that it was not even near base-level, although it is possible that a post-Carboniferous peneplane was preserved there at a fairly high level.

The original meander plane: ? 900-foot stage

No direct evidence has come to light yet that the Forest of Dean has been submerged since these times, but it appears likely that it was buried at some period during the Jurassic or Cretaceous, and that it was on an emerged surface of these deposits that the River Wye was first initiated. This was the view taken by Strahan (6) in his paper on the rivers of South Wales, with which he grouped the Wye, although he gave it no detailed consideration. The disrespectful manner in which the river ignores the structure of the area and meanders backwards and forwards across the outcrops of strata varying considerably in resistance is difficult to explain except on the hypothesis that the drainage is superimposed. Between Goodrich and Little Doward, for example, a distance of only $3\frac{1}{2}$ miles, it passes no less than six times from the Old Red Sandstone to the Carboniferous Limestone and back again across the narrow band of the outcrop of Lower Limestone Shales (see Fig. 2).

During the prolonged period of denudation that followed, the river must have reached maturity, even senility, and acquired the meanders that it has retained to this day, stereotyped by the entrenchment that followed rejuvenation and that is still proceeding. As will be shown later, there have been subsequent periods of still-stand during which fairly extensive planated surfaces have been produced, but these later denudation cycles never really achieved completion.

The amplitude of these meanders is considerable, in some cases as much as 3 miles, and for meanders on such a scale as these the flood plain must have been extensive and the valley floor wide and flat. The present plateau surface of the Forest of Dean does not appear to meet these requirements, and, furthermore, evidence has been deduced above that the palaeozoic rocks were not yet stripped of their mesozoic cover when the meanders were first developed. It seems likely therefore that the original meander plane was at a

Fig. 4. Reconstructed extension of marine platforms

higher level than the existing plateau of the Forest of Dean. Of this original plane no relics can be identified with anything approaching certainty, but it may be represented by the summits of a remarkable number of hills in the district rising to an altitude of 900 or 1000 feet (see p. 162).

The entrenchment of the meanders: 500-foot stage

Rejuvenation from one cause or another began the entrenchment of these meanders and the cutting of gorges from which the river has not since escaped, except in the very minor examples described on p. 175. Towards the close of the second cycle thus initiated a fairly advanced stage of planation was reached which is preserved in the conspicuous plateau that now forms most of the high land of the Forest of Dean (see Plate 1). The variation in altitude of the plateau is an indication of the incompleteness of the peneplanation at this stage, but the abruptness of its margin is clear evidence of the closure of this second cycle of denudation and the initiation of a third. The break of slope is abrupt and occurs at about 500 feet above the present river-level, and is therefore fairly closely defined by the 500 or 550-foot contour between Ross and the sea. An attempt has been made in Fig. 1 to indicate the extension of surfaces graded to this stage, but it should be clearly understood that this surface is an uneven one and perhaps hardly merits the designation "peneplane."

It is clear from the abruptness of the plateau edge that the rejuvenation is recent and that the entrenchment has been very rapid; the edge of the plateau is little dissected as yet, and the break of slope on the tributary streams has not migrated far upstream (see p. 167). Longitudinal profiles of some of these tributary valleys are shown in Fig. 3. Generally speaking the surviving portions on the Forest of Dean plateau are too fragmentary to make possible the reconstruction of the Wye profile at this stage, but the White Brook and Slade Brook present a fairly complete record of the denudation stages, the upper break indicating grading to a main stream at 550 feet. The lower break of slope in these two valleys indicates grading to a main stream at about 250 to 300 feet, and will be described later. In Cat Brook and Cleddon Brook, two short streams entering at Tintern and Llandogo respectively, this later stage has been entirely demolished by headward erosion, but a short fragment of the upper course, graded to the 500-foot level, is preserved.

The Liveoaks stage: 250 feet

The entrenchment of the river into the Forest of Dean stage did not continue uninterruptedly to the present base-level; there was a short interruption at a stage which may be correlated with a base-level about 200 feet above that of the present day. Extensive peneplanes were produced round Ross (see p. 165), but where the downward cutting of the Wye is going on vigorously in the Forest of Dean plateau this stage is only preserved in the bevelling of the spurs north of Chepstow (see p. 167) which afford confirmatory evidence; the three meander cores immediately north of Chepstow provide excellent examples, *i.e.* at Piercefield, Lancaut, and Liveoaks Farm (Plate 4).

Nearly every tributary between Ross and the sea preserves evidence of this stage in the slope of its thalweg (see Fig. 3). In every case there is a pronounced increase of gradient on approaching the confluence, and the curve of the

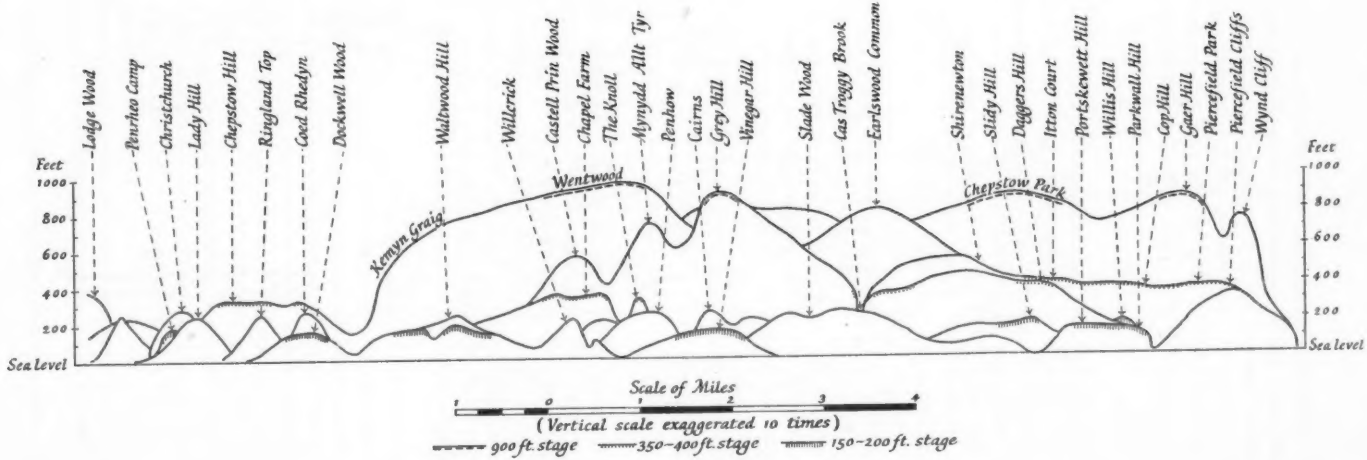


Fig. 5. Projected profile of north shore of Severn estuary between the Usk and the Wye

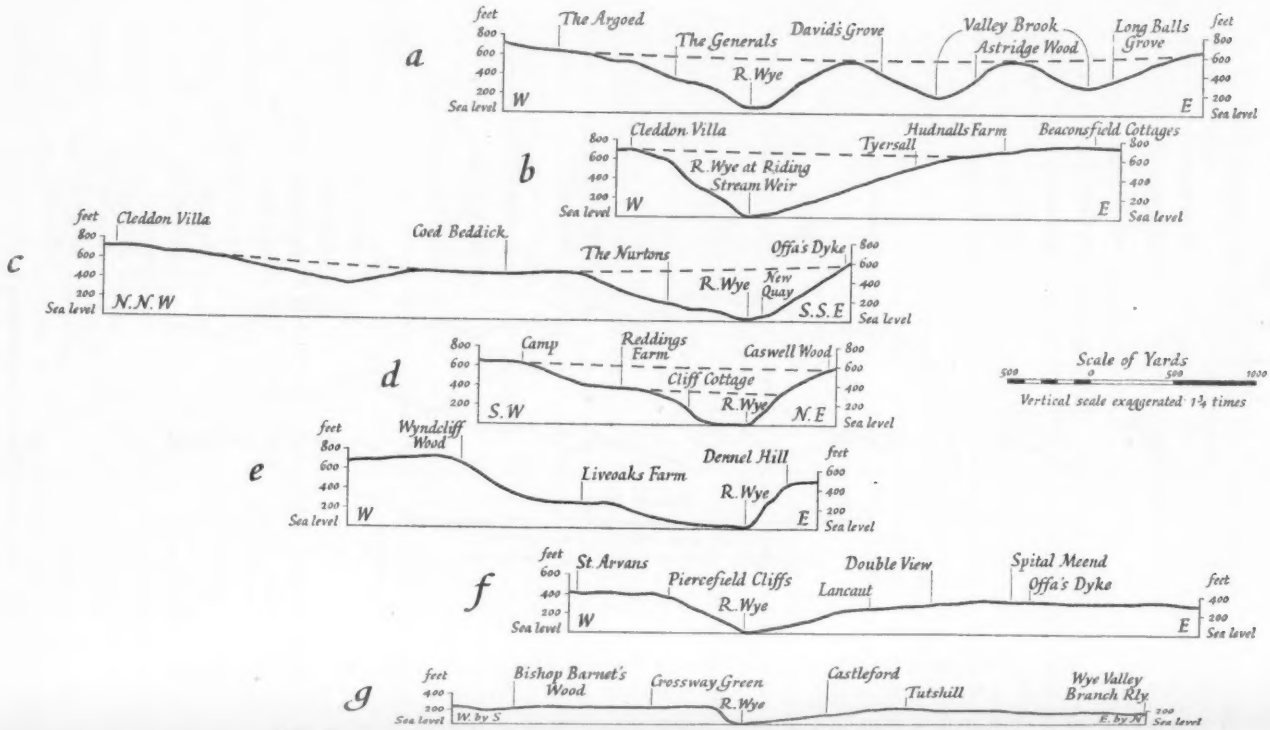


Fig. 6. Successive sections across the Wye, in order from north to south

middle reach shows grading to a level about 250 feet above the present Wye. In Fig. 3 the longitudinal profiles of these tributaries have been produced (broken) beyond the point to which rejuvenation has proceeded to their hypothetical confluence with the Wye in an attempt to reconstruct the thalweg of the main river at this stage. To the evidence thus obtained we may add that provided by the surfaces preserved on the spurs above Ross and the bevellings on the spurs below Chepstow, already described. The method does not lend itself to great accuracy, for even if the exact altitude of the break of slope on a spur is determined by theodolite there is still some doubt as to the exact position of the main stream at that period, and therefore as to the exact distance for which the curve of the profile above the break of slope should be continued. As far as the author has been able to determine by these methods the gradient of the River Wye at the 250-foot stage did not differ materially from that of to-day.

Fig. 6 shows a number of sections drawn across the valley from the 6-inch map, numbered *a–g* downstream; the lines of section are shown on Fig. 1. The Forest of Dean platform and the steep-sided margin of the rejuvenated valley within the ancient valley can be clearly recognized in *a*, *b*, *c*, *d*, and *e*. In *d*, *e*, and *f* the Liveoaks stage is recognizable in addition at Redding's Farm, Liveoaks Farm, and Lancaut. Other features of *f* and *g* are comprehensible only when the marine platforms are taken into consideration, and will be discussed later.

Fig. 6. Successive sections across the Wye, in order from north to south

Final adjustments

The degree of modification and adjustment that has occurred even since the 500-foot stage is remarkably small; the meander cores are worn and sharpened on their upstream faces (*e.g.* Liveoaks spur) though there is often little indication of this; nowhere have they been actually removed. The most conspicuous modifications are the three examples of high level cut-offs, described on pp. 165 and 166, in which the neck of the meander has been narrowed and finally severed by downstream encroachment of the swinging river and the abandoned bed of the meander left high and dry on the hillside as the river has continued to entrench its valley.

The last episode in the river's history is the drowning of the lower reaches by a considerable submergence, to be correlated, presumably, with the Neolithic sinking that caused the submerged forests that occur commonly along the coast of South Wales farther down the estuary. The effect has been to check the rate of downward erosion, but to accelerate the widening of the valley. Either process however tends to preserve the steepness of the river banks which are such a spectacular feature of the picturesque scenery of the lower Wye.

The marine platforms

To summarize what has been said of the physiographic history up to this point, there is evidence of three, or perhaps four, cycles of denudation in the lower Wye Valley giving rise to: (1) a somewhat hypothetical stage at about 900 feet above present river-level; (2) a well-defined stage at 450–500 feet above present river-level; (3) a well-defined stage at 200–250 feet above present river-level; (4) the present thalweg. Now if, as is most likely the case,

these successive stages are to be correlated with successive withdrawals of the sea or successive uplifts of the land, some trace should remain of the shore-lines of each stage, or at least of the lower stages, which ought to be recognizable along the shores of the Bristol Channel. Such evidence is provided by the coastal plateaux described on p. 167. The abrupt cessation of the plateau-like hilltops at 400 feet marks the inland limit of a coastal platform and the sudden rise behind to heights of 900 feet represents the old cliffed shore-line of this submergence. Similarly the abrupt seaward termination of the plateau-like hills at 150 feet marks the cliffing of the emerged sea-floor by encroachment of marine erosion after the withdrawal of the sea. Thus in Fig. 4 the contours reconstruct the original extension of the marine platforms on the assumption,

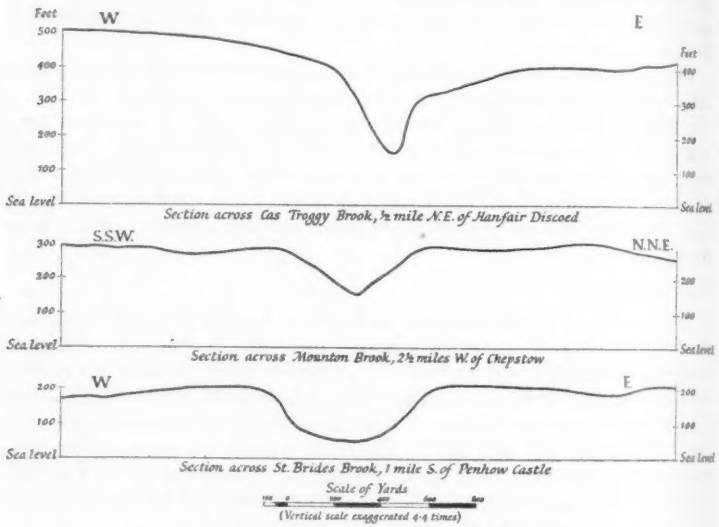


Fig. 7. Dissection of the marine platforms

which seems justified, that the hills represent the relics of a dissected platform or platforms of marine erosion. We must be satisfied however that the surfaces under consideration are erosion surfaces and not structural surfaces such as bedding planes. Actually the table-tops of some of these hills are determined by the outcrop of the flat Rhaetic beds, *e.g.* Lady Hill, Ringland Top, and Coed Rhedyn, but the majority of the hills are carved out of Carboniferous limestone, Old Red Sandstone, and Trias indiscriminately, and their flat tops and coincident levels are strong evidence of a common origin in a once continuous platform or series of platforms.

Now the succession of events already deduced from the study of the inland topography in the Wye Valley points to a clear distinction between two episodes in the physiographic evolution, a 500-foot stage and a 250-foot stage, which might be considered as graded to the highest and lowest levels in these coastal plateaux. But the line of demarcation between the two phases does not

emerge from the study of the coastal plateaux as clearly as events in the valley might lead one to expect. In Fig. 4 there is an indication, but little more than an indication, of two distinct levels afforded by the narrow spacing of the contours about 300 feet. But attention has already been directed to the existence of hills of intermediate altitude (Waltwood, Slade Wood, and St. Brides Netherwent) at about 250 feet, and others may be noted on Fig. 5, from which it would seem that the recession of the sea was somewhat gradual. In the field however some support can be found for the separation of two stages in some examples of a cliff-like seaward termination of the upper platform, as, for example, at Dinham's Wood. The road from Crick northwards to Shirenewton ascends abruptly from 150 feet O.D. at Crick to 160 feet, at which level it runs for nearly half a mile across the lower platform between meadows and cultivated fields, flat or gently undulating. It then enters Dinham Wood and climbs steeply to 350 feet in half a mile, emerging from the wood on to the higher platform which, like the lower one, is gently undulating and cultivated.

These platforms are everywhere undergoing dissection by streams graded to the present sea-level the cross-sections of whose valleys are remarkable, showing deep and sudden entrenchment into the flat platform, *e.g.* Mounton Brook near Shirenewton. The break of slope at the plateau edge is especially clear cut where the platform is made of limestone and where therefore the form of the land has been least subjected to subsequent modification by surface water. Cross-sections of three of these valleys are shown in Fig. 7.

Correlation of marine and sub-aerially formed platforms

It is clear that the Forest of Dean platform may be considered as graded to the 400-foot marine beach and the Liveoaks stage as graded to the 150–200-foot marine beach. The levels of these platforms of marine denudation, it will be noticed, are some 50 to 100 feet below the platforms of subaerial denudation identified in the Wye Valley, but this is only what would be expected. For a surface of subaerial denudation must be above sea-level, however maturely graded, while a plain of marine denudation is formed at a level whose upper limit is sea-level and whose height is "sea-level minus the depth of sea water covering it." When allowance is made for this the agreement is quite good.

Correlation with other areas

In the foregoing pages the succession of events has been treated in what appears to be chronological order, but it is not possible at the present juncture to assign any date in the geological time-scale to each. Attention may however be drawn at this stage to the close agreement between the denudation levels that emerge from this study and those described by several authors in other regions widely separated in Britain. Dr. Barrow (7) has described surfaces at heights of 900–1000 feet and 430 feet in the south-west peninsula; Dr. Sawicki (8) at 900 and 400–500 feet in North and Central Wales; McKenny Hughes (9) at 800–900 feet in the Lake District and Howgill Falls. The "higher lowland peneplane" described by Professor Ogilvie (10) has its lower limit at about 400 feet; Professor O. T. Jones (11), in his study of the upper Towy drainage deduced the existence of a previous base-level at 400 feet

above that of to-day. Platforms, probably of marine origin, at 400 feet O.D. are widely distributed in the South-West Peninsula, South Wales, and the London Basin, and these may perhaps be correlated, like the 400-foot platform here, with the 500-foot stage of river erosion in the Wye Valley, while platforms at 200 feet in the London Basin (12) and at 180 feet at Porthleven and elsewhere in Cornwall may, like the 150–200-foot beach here, be correlated with the 250-foot stage of Liveoaks.

The 400-foot platform especially has been recognized over a very wide area, including South Wales, the Cornish peninsula, the London Basin, the Midland Valley of Scotland, in Ireland, and in Brittany. It is generally assigned to the Pliocene, and it is possible that the main plateau of the Forest of Dean, graded to this stage, is of Pliocene age. But correlations on altitude alone are dangerous and imply allegiance to the "eustatic" hypothesis. I do not at the moment feel that it would be wise to assign a definite age to any of these stages, nor do I feel it desirable to adduce them as evidence in favour of any particular hypothesis of changes of level of land and sea.

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A NOTE ON AN EARLY TREATISE ON THE ASTROLABE

H. C. DARBY

THE well-illustrated work of Dr. Gunther[1] has given us a survey of the existing astrolabes scattered through the world and, among these, he has recorded some notable examples from the later Middle Ages. But the study of early treatises dealing with the astrolabe during this period raises a number of points. The work of Bubnov and Thorndike and Haskins[2] has revealed the part played by these treatises in the introduction of Arabic science to the west and, in particular, how they first appeared in Europe possibly towards the end of the tenth and certainly during the eleventh century. In the first place, there is extant a Latin treatise on the astrolabe in twenty-one chapters which may have been a translation from the Arabic and which may be placed among the doubtful works of Gerbert of Aurillac (950–1003) who later became Pope Silvester II. Associated with this, in many manuscripts, is another treatise, 'De Mensura Astrolabii,' attributed to Hermann the Lame, of Reichenau (1013–1054), sometimes called Hermannus Contractus and not to be confused with Hermann of Carinthia of the twelfth century. A note in one twelfth-century Oxford manuscript (Bodleian, Digby MS. 174, fol. 210b) states that the treatise in twenty-one chapters is by Gerbert and that when a certain B. read it he found only the uses of the instrument, and not its construction, described; accordingly he asked Hermann how to make an astrolabe and the result was the present treatise. In some manuscripts of another treatise, the 'Experimentarius' (sometimes associated with the twelfth-century name of Bernard Silvester), a certain *Hermannus* is depicted seated and holding a circular instrument which is superscribed *Astrolabium;* opposite him is seated another figure named Euclid grasping a sphere with his right hand, and with his left hand holding a rod or tube by means of which he is observing the stars (Bodleian, Ashmole MS. 304—thirteenth century; and Bodleian, Digby MS. 46—fourteenth century).[3] In some manuscripts also the prologue attributes the 'Experimentarius' to Bernard Silvester "not because he was the original author but the faithful translator from the Arabic into Latin" (*e.g.* Bodleian, Ashmole MS. 345—late fourteenth century). In the twelfth century also, Raymond of Marseilles (*c.* 1140) in the 'Liber cursuum planetarum' made frequent reference to an earlier treatise on the astrolabe which he himself had written (MS. 243 of Corpus Christi College, Oxford, ff. 53–62—fifteenth century. A twelfth-century fragment exists in the Fitzwilliam Museum, Cambridge, McClean MS. 165, ff. 44–47). Raymond went as far as to describe himself as the first of the Latins to introduce the science of the Arabs to the west. That was manifestly untrue, for it is evident that both the astrolabe and also Arabic terms were current in Europe by the eleventh century.

[1] 'The Astrolabes of the World,' 2 vols. (Oxford, 1932).

[2] Bubnov, 'Gerberti Opera Mathematica' (Berlin, 1899). Thorndike, 'A History of Magic and Experimental Science,' 2 vols. (London, 1923). Haskins, 'Studies in the History of Mediaeval Science' (Harvard, 1927). See also Duhem, 'Le Système du Monde,' 5 vols. (Paris, 1913–1917).

[3] In both manuscripts one is called Euclid; in the older manuscript only is the other figure named.

What part did England play in this development of the eleventh and twelfth centuries? Dr. Gunther declares that, apart from Chaucer's translation of Messhala's treatise in 1391, "the oldest treatise by an Englishman appears to have been 'De Operatione Astrolabii,' by William Batecombe, who flourished in the reign of Henry V, *c.* A.D. 1420." Actually however other Englishmen had preceded William Batecombe. In 1092 Walcher, prior of Malvern (originally from Lotharingia), had observed the eclipse of October 10 by means of an astrolabe which, using Arabic terms, he described early in the twelfth century as a thing apparently well known to his readers (Bodleian MS. Auct. F. i. 9, ff. 86–99—twelfth century). It is significant to note that Walcher was associated with a certain Pedro Alphonso, who was apparently a converted Spanish Jew. Coming from the middle of the twelfth century (the late forties) is another treatise on the astrolabe by Robert of Chester (called variously Robertus Retinensis or Robert of Ketene) who, we know from other sources, had spent some time in Spain living near the river Ebro (Bodleian MS., Canonici Misc. 61, f. 22b; see also Bodleian, Digby MS. 40, which does not however mention the author's name).

But the main figure in the English reception of Arabic science was Robert of Chester's elder contemporary—Adelard of Bath. Little is known of his life beyond a reference in the Pipe Roll of 1130. Among his numerous writings, those of direct geographical and astronomical interest are:

(1) 'Ezich Elkauresmi.' A translation of the astronomical tables of al-Khwarizmi, as revised by Maslama at Cordoba. One Bodleian MS. is dated 1126.

(2) 'Quaestiones Naturales.' This purports to explain what Adelard had learnt from the Arabs. The manuscripts are numerous.

(3) 'De Operatione Astrolabii.' From the prefatory material this might be placed in the early forties of the twelfth century. It may have been written at Bath; at any rate the meridian of Bath is taken for purposes of illustration. It quotes the 'Ezich,' and also an earlier treatise, 'De eodem de diverso,' as well as an earlier translation of Euclid's Elements. It has been listed by Haskins, and the purpose of this note is to draw attention to it because, as far as I know, it is the earliest treatise on the astrolabe written by an Englishman. It may be that other treatises lie obscured in manuscript collections. Of this one there are two manuscripts. One is in the Fitzwilliam Museum at Cambridge (McClean MS. 165, ff. 81–88), whose catalogue by M. R. James dates it as "Cent. xii (before 1175)." The other is in the British Museum (Arundel MS. 377, ff. 69–74), whose catalogue ascribes it to the thirteenth century. The McClean MS. is bound in a volume of astrological tracts; its preamble begins, "Incipit libellus magistri Alardi bathoniensis de opere astrolapsus." The Arundel manuscript is evidently a later and shortened version. It is incomplete at the beginning nor does it include the four full-page illustrative figures that are left unfinished at the end of the McClean text. Both manuscripts however have some diagrams incorporated in the text.

Adelard's treatise has this in common with Chaucer's treatise—that it is directed to a young scholar, Henry the grandson or nephew (nepos) of a king—possibly Henry Plantagenet. The terms of the dedication mark the coming of Arabic learning to the west: "Hence it comes about that not only

do you survey with understanding those things which are contained in the writings of the Latin, but also you desire to understand the opinions of the Arabs upon the sphere and the orbits and motions of the stars." There follows, in the McClean manuscript, the usual apparatus of geocentric astronomy—the round earth with its surrounding spheres, the signs of the Zodiac, and the movements of the Heavenly bodies. Then comes the substance of the treatise contained in both manuscripts. His own words on folio 83 sum up the uses of the astrolabe, and I am indebted to Mr. D. A. G. Hinks for a literal translation:

> in the first place, the amount of the Sun's movement for each several hour, in Arabic *artifa*, which we may term altitude; also the same for the hours of the night and the stars: secondly, what sign or what degree of the same the Sun occupies every day: thirdly, the length and breadth horizontally, the height upwards and the depth downwards of any visible terrestrial body; and, if they be of some exact figure, their exact measure: fourthly, the relation to each other of bodies and their shadows: fifthly, the longitude or latitude of any region you please.

This last assertion concerning the determination of longitude would seem to raise grave doubts about Adelard's real knowledge of the instrument and its working, but he saved himself from error when he came to expand the point: "you must know therefore that my masters have not up to the present determined the longitude of regions by any means other than by the difference of the times of an eclipse. But when you desire to determine the latitude of any given region. . . ." Indeed, Adelard's familiarity with the science of the Arabs was far from being a superficial matter, and his treatise on the astrolabe deserves to be more widely known.

SPANISH GEOGRAPHICAL STUDIES

SÍNTESIS FISIOGRÁFICA Y GEOLÓGICA DE ESPAÑA. By EDUARDO HERNÁNDEZ-PACHECO. (Trabajos del Museo Nacional de Ciencias Naturales. Serie Geológica, núm. 38.) *Madrid* 1934. 9½×6½ *inches; 584 pages; illustrations and maps.* 30 *pes*

ESTUDIO DE LA REGIÓN VOLCÁNICA CENTRAL DE ESPAÑA. By FRANCISCO HERNÁNDEZ-PACHECO. *Madrid: S. Aguirre* 1932. 10½×8 *inches;* vi+236 *pages; maps* (18 *sheets,* 1 : 100,000, *in separate folder* 11½×15½ *inches*); *profiles* (2 *sheets in folder*); *and illustrations*

BOSQUEJO PRELIMINAR DE LAS COMARCAS GEOGRAFICAS DE Extremadura. (Caceres, Badajoz y Huelva.) By FRANCISCO HERNÁNDEZ-PACHECO. *Madrid* 1934. 9½×7 *inches; 97 pages; illustrations*

RASGOS GEOGRÁFICO-GEOLÓGICOS DEL VALLE DE ALCUDIA. By FRANCISCO HERNÁNDEZ-PACHECO. *Madrid* 1933. 9½×7 *inches; 27 pages; illustrations and maps*

DESPITE the ebb and flow of Spanish political conditions, the Junta para Ampliacion de Estudios y Investigaciones Cientificas continues its work of publishing at national expense the finest researches of the country. Its latest publication—the first at the head of this article—is at once an authoritative statement of the physiography of the whole Peninsula and the culmination of a life's work on the part of the author. Sr. Eduardo Hernández-Pacheco here

brings into one complete study the results of a long series of monographs based upon field work by himself and his son and disciple, Francisco. In this respect alone, that it embodies the result of surveying the peninsula intensively and personally, it ranks as the most prominent contribution of recent years to hispanic geography. As the title implies, the work relegates to second place the technical geological discussion of the long-period time factors in the Peninsula and brings to the fore an aspect of that structure hitherto only sketched. This physiographic aspect has remained only lightly dealt with for the simple reason that no one till now has spent sufficient time working in the field on the subject. Too much has been written about Spain from a few cursory glances—a fatal mistake as current among native writers as among foreigners.

Sr. Pacheco's keynote is given by the first chapter, where he tackles at once the lithology of Spain and divides the peninsula into three parts: the siliceous, the limestone, and the clay. Then he turns to orogenic character in which he concerns himself chiefly with an analysis of present land forms and their stages of evolution. Incidentally he uses a pair of good terms: the *Hesperides*, for those peneplained roots of old folds of a dead cordillera, showing now in N.–S. alignments from Galicia to Sierra Morena and even in detached fragments in Sierra Nevada; the *Hispanides*, for those rejuvenated old mountains of early Mesozoic decompression, aligned E.–W. in the Cantabric Cordillera and the mountains of Leon, Oretana, and Sierra Morena. These and succeeding chapters on surface qualities are masterly in their command of fact and in the broad vision of their generalizations. In the treatment of climate less confidence can be felt, and the nomenclature, while demonstrating the variety of Spanish climate, lacks precise definition. Greater light is thrown on the climatic influence by his full and exact statements of the vegetation belts arising from the interplay of lithology and climate. It is a pity he throws no light on the growing feeling that much of what Reyes Prosper classed as steppe is really *barbecho*.

The main body of the work is occupied with an examination of the different *paisaje* or landscape types in Spain, strongly emphasizing their physiological character yet sketching in their effects on vegetative and human economics. Sr. Pacheco defines his idea of landscape as "a synthetic expression of the physiographic circumstances and geological conditions which act together within a country," and develops a broad regional analysis, discussing each region in considerable detail. The final group of natural regions corresponds closely to Unstead's division. As the work proceeds the interest in human geography increases, and, while it can be justly said that this book will form the starting-point of any future study of the peninsula, it is to be hoped that it will be the precursor of full-length studies of human geography based on similar field work. The author confesses that his study is not of even intensity owing to the large scale on which it is drawn and to the fact that the greater part was done "del principio." He modestly claims that there is no point of Spain within a radius of 5 miles of which he has not examined conditions personally. On Extremeña and the Meseba, areas whose difficulties cause them to be avoided by most observers, he shows the authority of long and intimate experience. In a series of papers given as an Appendix there is printed a verbatim report of Sr. Pacheco's speech to the Asemblea de Reforma Agraria (1931) in which he added the advice of one knowing the ground and its conditions to steady those impassioned orators who, by flowery projects, expected to produce a flourishing Spain: here, likewise, is an extended and illuminating survey of La Mancha geography.

Technically the book is a fine production: in fact it must be one of the best-printed pieces of geographical work yet published in Spain. The photographs, all new and taken by the author, are excellently produced in such abundance

that they will certainly reappear in most future books on Spain. It may be asked whether less profusion of photographs and a series of equally well-chosen block diagrams would not have illustrated better certain aspects of the physiography; a more detailed index would also have improved so large a book. Yet the fact that it leaves us unsatisfied on some points only shows the great satisfaction which the book gives as a whole.

The second work is a very complete study which illustrates yet again the excellent work being done by Spanish geographers under circumstances causing it to pass unnoticed by the general body of European geographers. If some justification exists for the view that, geographically speaking, of western European countries Spain alone remains "dark," there is none for thinking that Spaniards themselves are not attempting to unravel the complexities of their peninsula. The work of Francisco Hernández-Pacheco and of his father in Extremeña, of Urabayen in Navarra, of Carandell in Andalucia, only typify a few of those many other single-handed geographers carrying out a vast amount of urgently needed field-study. It is to be regretted that the published results rarely get to England unless some energetic hispanist goes out of his way to make special arrangements; though international geographical congresses should lead to the interchange of materials. That Spanish studies do not arrive in England is the more surprising since the authors are willing and anxious to give their work for this purpose when once the idea is proposed to them. The Comité Hispano-Ingles of Madrid, among its many worthy cultural activities, might well enlist the services of an English scholar in touch with English university movements, whose purpose should be to aid English-Spanish intellectual co-operation by exchanges of materials.

The work under review, by the lecturer in Physical Geography in the University of Madrid and sometime assistant to the Instituto Geologico, was written as a prize work of the Academia de Ciencias Exactas, Fisicas y Naturales de Madrid, after two years' work in the field. The emphasis of the study is thus on the physical and geological aspects of the area considered. This area, nearly square, including Ciudad Real and Almodóvar del Campo, covers that country from the foothills of the Montes de Toledo to where the Meseta breaks down into the Sierra Morena and is limited less precisely by rough meridians through Luciana to the west and Daimel to the east. It is an interesting district of volcanism, dated by the author somewhere between the Upper Miocene and middle Quaternary, very little known and therefore requiring specially careful field-work. Criticism of such ground work can only be superficial until some one else covers the same area on a similar study: such proof-work has not been done and so this study must rank as one of the basic contributions to Spanish geology. The results of this personal research in Extremeña are contained partly in the book and partly in a supplement of clearly executed 1 : 100,000 geological maps and sections; these alone must represent a heavy labour since for the greater part of the area 1 : 50,000 topographical sheets have not been published. Unfortunately the yellow colour used to indicate miocene deposits obliterates completely the contouring of that deposit.

Geographers may wish that the initial chapters discussing the broad regional division had been slightly expanded to cover fully the human and vegetable effects of the physical circumstances, especially as the illustrations and remarks in the text indicate the author's capacity in that direction. Geologically the exposition of the strata qualities and mineralogical characters remains impeccable and, if we regret that more block-diagrams were not included, it is because those given are so well executed by Carlos Vidal y Box. Many clear photographs

are presented, the whole work has been carefully produced without regard to cost, and the author is to be congratulated on a solid contribution to the growing body of Spanish scientific research.

The Instituto de Reformas Agrarias in Madrid was created by the Spanish Republic in 1932 to serve a double purpose: to act, on the one side, as technical board, advising and informing the legislative body regarding the long overdue reform of Spanish agrarian affairs and, on the other side, to help put into practice such formulae as the Cortes ultimately decreed for the solution of agrarian questions. In its first capacity as adviser the Instituto realized the urgent need to remove agrarian questions from the heated field of political debate and to base them upon sound geographical facts and local circumstances. Unfortunately for its purpose, the Instituto knew that a complete series of detailed regional studies does not exist for Spain, and it at once began such a series. F. Hernández-Pacheco was one of those appointed as geographical advisers, and these two reprinted studies by him are the only ones which have yet appeared in the monthly bulletins of the Instituto. They serve as excellent views of the little-known southern Meseta.

The two studies are of distinct types. The first ('Comarcas Geograficas,' etc.) is a broad regional analysis of Extremadura within limits of an entirely political nature. This area gives an admirable section across the southern profile of the south-western Meseta, treating of the Middle Tagus valley, the Montes of Merida, the Middle Guadiana, the Sierra Morena, and finally of that Huelva part of the Betic Plain known as La Marina. The author carefully points out that his work is a "sketch" to act as the basis for ampler examinations such as would throw light on the local conditions in an area where need for agrarian changes are long-standing, and where the wide range of circumstances met would be of inestimable value in judging the types of reform suitable for other parts of Spain. It is amply illustrated and contains useful—if short-term—climatic data. The omission of a sketch-map of different soil qualities—a matter which for agricultural purposes is at least as important as the geology of the subsoil—is surprising.

The second study, of the Valle de Alcudia, treats of a much smaller area due south of Ciudad Real on the fringe of the Meseta, and is much fuller. Its origin indicates the ideal towards which the Instituto directs its methods. In the Valle arose the historic dispute between the claims of agriculturalists and the needs of cattle drivers who, for many years, had used the valley as winter pasture for cattle, sheep, and goats, which migrated for the summer, on foot or by lorries and railway, to the Sierra de Guadarrama and other mountains, even reaching as far north as the Cantabrians. These rival claims were lodged with the Instituto, which specially commissioned Sr. Pacheco to examine geographical conditions in the area of the dispute. Hence this work on an area which, by geographical circumstances, can only be used for half the year as pasturage and which suffers so much from drought as a consequence of the shale subsoil and scarce rains that any agricultural crop is only possible once in five or six years. Such "robber' agriculture, the author points out, brings a set of serious evils which make grazing the most economic use of the land. This study is likewise well presented with clear photographs of the landscapes, maps, and diagrams. Particular interest attaches to a diagram of Guadiato flood-periods.

It is to be hoped that these first studies by the author for the Instituto de Reformas Agrarias will not be the last, for a complete group of them would throw much light on real economic and geographic conditions in rural Spain to-day.

E. H. G. DOBBY

REVIEWS

EUROPE

THE NEW FOREST. By JOHN C. MOORE. *London: Chapman and Hall* 1934. $7\frac{1}{2} \times 5$ *inches;* 186 *pages; illustrations.* 7*s* 6*d*

The author spent more than three weeks in October and March riding and tramping through the New Forest, and it is surprising how much he observed in so short a time. Alert, full of zest, high-spirited, and with a broad outlook and pleasing style, he makes a capital book—not packed, it is true, with information, but describing his discoveries and personal reactions to what he saw. Among books on the New Forest it stands out as a fanciful, light-hearted, and somewhat poetical presentation of the dark places and of the silent foresters. His text is aptly and charmingly illustrated with charcoal drawings by Mr. Barrington Browne. There are adventures with the horse, Simon, and a walk through the night and some bogs from Beaulieu to Lyndhurst. No guide-book could get the atmosphere so admirably—the place and its people, their sayings and ways. Why did the author, who makes much of the "ancientness" of this region, not plumb below Edward the Confessor and William the Conqueror? Obviously Mr. Heywood Sumner has not swum into his ken. Otherwise he would have told us how Roman-British potters worked at least a baker's dozen of kilns, turning out specialized forms of pots during the third and fourth centuries, chiefly in the north-west corner of the Forest; how a Roman road from Nursling led past Cadnam, Castle Malwood, and Stony Cross; and how the Roman is traced at Noman's Land, the Park of Lyndhurst, Beaulieu, and Buckland Rings. Clearly the past of the Forest might have been traced further back by five centuries. Even with a writer who rather affects whimsicality and studied his map on his horse's mane, the reader is surprised when the Avon Valley is said to be east, and Southampton Water west, of the Forest; while the direction from Cadnam to Southampton Water *via* Colbury (?Holbury) is given as south-west (pp. 9, 23). And that "Roman" arch at Lyndhurst will hardly pass muster. But indifference to the Roman and orientation are trivial matters compared with good stories and excellent descriptions, among others, of the Verderers' Court, a ride with the Agisters to a round-up of ponies, extracts from Manwood on the laws of the Forest, and the marshalling of the evidence on the death of Rufus. There is no heavy going in this book. S. E. W.

HOOTON PAGNELL: the Agricultural Evolution of a Yorkshire Village. By ARTHUR G. RUSTON and DENIS WITNEY. *London: Edward Arnold* 1934. $10 \times 6\frac{3}{4}$ *inches;* viii + 459 *pages; illustrations and sketch-maps.* 25*s*

Dr. Ruston and his collaborator Mr. Witney have produced a volume which takes its place at once as a standard work on a topic of deep interest at the present, namely the agricultural evolution of a portion of northern England. Although a product of much research, the book does not read so tediously as many monographs and succeeds in hiding the framework of the preparatory groundwork so that the product reads as a harmonious whole. The method adopted is to give full verbal pictures of conditions at the present and at the time of the Domesday record, and having established the difference in conditions, to analyse the factors of enclosure, changes in farming technique, ownership, tenure, tenant rights, tithe, and glebe. What amounts to an index stands at the head of each chapter, while the argument is usually well summarized at the end. The photographs are well chosen; the line illustrations are of three types: maps, old farming

implements, and graphs. The second of these are drawn from the Luterel Psalter of 1340, and, since for a time the Luterel family were Lords of the Manor here, are especially apt. The graphs, while few, are striking, *e.g.* the one showing the inverse ratio of total population to the number of agricultural workers from the eleventh century to the present time over periods of change correlated with the enclosure (p. 84), and the pair of graphs (pp. 97, 99) correlating the price of wool and wheat with the Enclosure Acts in England, which demonstrate how the rise of prices encouraged the enclosure of land in the immediately succeeding years.

While one important aspect of this volume is a study of the past the present has never been forgotten, and the work shows how the present is controlled by the past as well as by the physical environment. The dynamic changes are not exaggerated and due attention is paid to the background features of relief, soils, and transport. The authors have taken a more than parochial outlook for a parish study: an attitude well illustrated by the concluding chapter. The Tudor tithe barn at Hooton Pagnell which still exists (the reference on p. 387 to the illustration should read Pl. 11, p. 414, and not Pl. 10, p. 388), is of no further communal use save for concerts; and the reasons both for its construction and abandonment are fully discussed in relation to England and the Continent as well as explained by the local commutation of parish tithes about a decade after earlier agreements of the eighteenth century. The thorny question of tithe troubles of the arable areas of the south and east of England are stated to be due to the growth of the owner-occupier in these regions and the peak period of price trends, a relic of the Great War, the analysis of which is carefully presented. Finally the semi-official pronouncements of farming and ecclesiastical interests are reported.

This volume, of use to all interested in the agriculture of this country, has but one drawback—the rather high price, which however is compensated for by the production, which is a credit to publishers and press. A. C. O.

EUROPE: a Regional Geography. By MARGARET REID SHACKLETON. *London: Longmans, Green & Co.* 1934. 9×5½ *inches;* xvi+430 *pages; illustrations and maps.* 15*s*

This book essays to give in four hundred pages an account of the whole of Europe, of all the countries of which the publishers assert that the author has first-hand knowledge. The treatment is described in the preface as "fundamentally physical," but it is also stated that account is taken of the whole natural environment of the regions, and of the results of their different histories. This being so, the book seems to the reviewer to set out to attempt the impossible, considering the limits of its length, and the result of the inevitable compression is that the treatment is in many respects inadequate. Thus, one paragraph has alone to dispose of the problems of the fjords, of the strand flat, and of the skerry guard of Norway, while the economic summaries that follow the different sections have no reference at all to such important considerations as those of transport and markets. It is difficult also to see any real value in an account of the Industrial Revolution in Britain that is limited to some three pages, and so of necessity to such general matters as must be already familiar to University students for whom the book has been prepared. That despite such condensation the author has written a text-book that contains so much material and yet is easy to read is a tribute to her powers of clear expression and methodical arrangement, and it is easy to imagine it becoming popular among students on this account. The scheme followed of adopting a compromise between divisions based on Natural Regions and those based on political divisions, while apparently

contradictory, works out well, and the author has made very good use of her opportunities in the more general sections. There is a satisfactory index, the more important references are cited, and many photographic illustrations given. While some of these are good it is doubtful whether others (*e.g.* those on pp. 108, 277, 351) add much to the value of the text. With regard to the detail of presentation one notices a few grammatical slips (*e.g.* the confusion of singular and plural, p. 21), and while the inclusion in parenthesis of varied forms of place-names is in itself useful the constant use of brackets for this and other purposes becomes in places distracting. Otherwise however there is little but praise for the general form and appearance of the book which is easy both to read and handle. B. H.

BEYOND THE ALPS. By ION S. MUNRO. *London: Alexander Maclehose & Co* 1934. 9×5½ *inches;* xii+298 *pages; illustrations and sketch-map.* 8*s* 6*d*

The chapters on Rome are the most valuable in this lively, well-informed book. It is true that Mr. Munro takes us from end to end of Italy, but in the non-Roman sections, especially when in the north, he tends to merge into the intelligent tourist, and his pages, often holiday pages, become more colourful—a word for which he has a special weakness—and less individual, though he never descends to the obvious or the commonplace. His wise habit of keeping largely to one idea in each essay is less happy in its results when he is covering a wide area like the Romagna, where he is looking all the time for Paolo and Francesca, without a thought of the Sforzas or Leopardi or Pascoli, or even of Sigismondo Malatesta at Rimini. In the chapter in which he cleverly touches off the characteristics of the chief Italian cities it is Rome that comes out worst; it is not to be treated impressionistically by a newspaper correspondent of twelve years' standing. He has a keen eye—an artist's eye—for detail and he can describe like a trained journalist. Even readers who know Rome well will enjoy his papers on the Santissima Madonna of the Abruzzi or the glancing Madonnanear Tivoli, the weekly *lotto* or the duels or the Befana, the festival of the tailors at S. Omobono or that of Noantri in Trastevere; on the Roman shoeblacks or that amazing mushroom growth, modern Ostia, the Roman Southend; on the carts and marionettes of Sicily. Mr. Munro gives interesting information about changes to come, such as the new central railway station at Ponte Molle, which has already vulgarized the Via Flaminia and is ultimately to bring with it the boring of a tunnel for traffic by the Piazza del Popolo under the Pincio, to be followed by two others which will debouch respectively near the Piazza Barberini and the Piazza di Spagna. The Via della Croce, with, among many other associations, its memories of Browning, is also apparently doomed. L. C.-M.

ASIA

IN THE STEPS OF THE MASTER. By H. V. MORTON. *London: Rich and Cowan* 1934. 7½×5 *inches;* 388 *pages; illustrations and maps.* 7*s* 6*d*

Mr. H. V. Morton is so widely known and deservedly appreciated through his popular Guides, "In Search of" various parts of Great Britain, that a book by him on Palestine is sure of a large circulation. Parts of this volume were conspicuously advertised when they appeared in one of the London Dailies.

In spite of the large output of books on Palestine the book has a distinctive character which gives it a place of its own among the reading public. It is not in any sense a critical or scientific work; it avoids all controversy; it accepts things as they are with a wide sympathy; it is imaginative, devotional, and mystic. The last half-century of archaeological work in Palestine hardly exists

for the writer; the War and British Administration is scarcely touched upon; the whole problem of Zionism is ignored as well as modern religious activities and problems. Nearly all of it might have been written many years before the war and much will in essence be of abiding interest for many years to come. Doubtless for very many who seek a spiritual vision it will suggest the ideal mental attitude for a visit to the Holy Land. The book is discursive but never dull, and is written in the first person. References to the Gospels and to Josephus are quoted at length—an arrangement very convenient for fireside reading or on travel. There are some accounts, tantalizingly brief, of visits to less known places such as Kulat el Husn (Krak-des-Chevaliers), Jerash, Machaerus, and Petra.

In a work so generally accurate there are a few mistakes which might desirably be corrected in a second edition. The two boys, mentioned on p. 70, accidentally discovered the Siloam inscription, not the tunnel, which was known long before. In paragraph 2, p. 198, surely *eastern* should be north-western? El Kedir (p. 237) should be el Khudder; el Bikar (p. 258) should be el Bika'a. The reference to *mensa Christi* (p. 224) is clearly a mistake, and the spelling of Joun in the French form Djoun is, to say the least, unnecessary. These are however very small blemishes in a work which admirably recalls an attitude to the Holy Land which is apt to be forgotten amidst the acute political, commercial, and religious problems of to-day. The illustrations are excellently reproduced and greatly add to the attraction of the book. E. W. G. M.

ANCIENT SIAMESE GOVERNMENT AND ADMINISTRATION. By H. G. Quaritch Wales. *London: Bernard Quaritch* 1934. 9×5½ *inches;* viii+264 *pages.* £1 1*s*

Sixty years ago Chulalongkorn, King of Siam, perceiving that if he would preserve Siamese autonomy he must conform to Western ideas of government, and being at the same time loth to relinquish the sanctified despotism exercised by his ancestors, devised and presented to his people a system resembling a liberal constitutional government in all respects except for a proviso to the effect that His Majesty could over-ride it at any moment if he so desired! Because of his many virtues and the possession of his people's reverence and affection, this compromise between ancient custom and modern necessity had a marked success, but after his death it became unworkable and, two years ago, was swept away by a small but resolute Party of Progress, who broke clean away from the past and set up a People's Government the stability of which they are now doing their best to establish.

At this juncture, with Young Siam contemptuous, in its democratic enthusiasm, of the many virtues of the national tradition, comes Dr. Wales with this treatise on early forms of Siamese State organization as a reminder that everything old is not therefore unworthy, and that the country's ancient laws and usages, formed and adapted by Oriental wisdom to suit Oriental conditions, include a good deal well worthy of consideration by even the most advanced of young Oriental politicians. But the book is more than a mere pointer for apprentice politicians. The laws, religion, and culture of Siam are all of Indian origin, received indirectly through Cambodia, Pegu, and Burma, countries with which Siam has always been in close contact, and the author's pictures of ancient Siamese government and administration have much antiquarian value, as revealing the very early diffusion of Indian culture through the Orient, and supplying details of customs and institutions that, while their vestiges may still be perceptible here and there in the Protected States, have for the most part vanished from India long ago.

It is only within the last twenty-five years or so that serious attention has been paid to Siamese history. Of matters prior to the fourteenth century A.D. there are no authentic records beyond two or three stelae recently unearthed by archaeologists, wherefore the history of those early times is still little more than conjecture. But of the period since A.D. 1350, when Siam first appeared as a definitely independent and united kingdom, there is an accumulation of evidence which a group of enthusiasts, led by the learned Prince Damrong, has explored and collated and proved to be, in the main, reliable. Out of this material Dr. Wales has compiled, within the covers of this small volume, a concise review of each phase and aspect of a wide subject. He divides his work into eleven chapters in which the Monarchy, the People, Administration, Army, Law, Church, and so forth are separately examined and traced from their emergence out of the mists of antiquity down to King Chulalongkorn's reformation in A.D. 1873. He records developments due to foreign contacts and kingly caprice, a veering of the Monarchy from the Paternal to the Tyrannical, and a progressive deterioration of the whole system, yet leaves the impression that the passage of five or six centuries has wrought remarkably little fundamental alteration in the State organization.

Dr. Wales has not yet outgrown a mildly didactic manner, and students will find, here and there, statements advanced as facts regarding which historians still admit a measure of uncertainty; as, for instance, the curt disposal on p. 12 of the question of Burmese cultural influences in Siam, and the repeated assumption that ancient custom ordained the descent of the Siamese succession from father to son, a long-disputed contention which seems scarcely borne out by the fact that so many successive kings found it desirable to issue decrees with the object of securing the throne to their sons. And there is also an insistence on the importance, for Siamese culture, of the victory over Kambodia in A.D. 1431, which some may consider unnecessary. But apart from this slightly positive tendency the work is full of merit and will surely be recognized by all those interested in Siamese history and Oriental archaeology as a valuable addition to the literature of a subject of which Dr. Wales is in course of becoming one of the foremost exponents.

The book has a bibliography and an index. W. A. G.

RATHJENS VON WISSMANNSCHE SÜDARABIEN-REISE. Vol. 2. Vorislamische Altertümer. xvi+212 *pages*. Vol. 3. Landeskundliche Ergebnisse. xvi+230 *pages*. By C. RATHJENS and H. VON WISSMANN. *Hamburg: Friederichsen, de Gruyter & Co.* 1932, 1934. 10½×8 *inches; illustrations and maps*. *M.* 15, 20

In 1931 Herr von Wissmann with Herr van der Meulen made a notable journey into the Hadhramaut; of this journey an account has appeared in English, and was reviewed in the *Journal* for January 1933. The expedition with Herr Rathjens recorded in these volumes was made earlier, in 1927–28, though the publication of results is only now completed. The original intention was to conduct archaeological and geographical researches in the Hejaz, but permission was refused and the journey into the Yemen was substituted at the last moment. This diversion was unfortunate, for in travelling the Hodeida–San'a route they were on comparatively well-known ground. However, they evidently made the best of their opportunities, and collected much information on the country, besides obtaining interesting archaeological results.

From San'a, where they were the guests of the Imam, they hoped to be allowed to visit the practically unexplored desert region to the east, about which they had heard tales of ruined Himyaritic cities. One of these, near Hamir Gani

was said to cover an area as large as San'a. Once more however they were disappointed; the journey was alleged to be too dangerous, and they were taken to a site at Hugga, about 22 km. north of San'a. Here excavations had already been begun by the Imam, partly from an interest in antiquities, but also to obtain building material. The travellers did what they could to control operations, and succeeded in uncovering the ruins of a temple of the "sun goddess," dating between 100 B.C. and A.D. 100, which had apparently been destroyed by a lava flow. Later, they visited Hay, where buildings appear to rest upon foundations of early Islamic times, which in turn overlie the remains of an earlier civilization, and several pre-Islamic cisterns and other sites near San'a. It is amusing to note that even in the Yemen faked inscriptions and coins are offered to travellers.

The geographical results of the journey are given in descriptions of the six zones into which the authors divide the Yemen. They express their opinion strongly that the Yemen is a highland fault block, as clearly marked off from the eastern deserts as from the coastal Tihama. They have however modified their previous statement that San'a lies in a rift valley: whatever may have been its origin, the forms of the San'a region are now due to extensive erosion of the horizontal beds. It has also been the scene of considerable volcanic activity, extending into historic times, the lavas of which are correlated to those of the Red Sea and Aden rifts. Geological sketch-maps and profiles and a list of rocks collected accompany this study. Much information is also given about the life of the people, agriculture and industries, religions and civil divisions. This includes a description of the "sūqs" or market towns occupied on the day of the market only, and deserted during the intervals. It is stated that there are approximately 70,000 Jews in the Yemen.

Volume three is accompanied by a map in three sheets, on the scale 1 : 100,000, of the country between Hodeida and San'a. The basis of this is Glaser's determination of the position of these two towns, von Wissmann's compass traverse, aneroid barometer observations, a large number of bearings, and numerous photographs. To this has been added the work of earlier travellers, particularly details contained in the unpublished journals of Glaser and Schweinfurth. The map corrects the earlier ones in several details. Form lines are in brown at approximately 30-metre intervals—a distinction is made between the work of these travellers and their predecessors—and cultivated land along the route in green.

Some reference must be made to the excellent photographs, of which there are nearly three hundred in volume three alone. Those illustrating the land forms are particularly striking. It is improbable that so comprehensive a collection for the Yemen has previously been published. G. R. C.

THE CHINESE PEOPLE: their Past, Present, and Future. By A. S. ELWELL-SUTTON. With a foreword by J. PERCY BRUCE. *London: Ivor Nicholson and Watson* 1934. $7\frac{1}{2} \times 5$ *inches;* 264 *pages.* 4*s* 6*d*

This book is of much more modest dimensions than its rather ambitious title might suggest. It is indeed a highly condensed narrative and interpretation of China from the time of the classical sages to the present day, with a short final chapter on "The Future." In the arrangement of the subject-matter and chapters it still exhibits the lecture-form out of which it evidently originated; indeed it is one of a series described as "The University Extension Library." The vastness of the material to be handled in so concise a manner inevitably precludes any detailed analysis or full discussion of the many intricate problems which the story of China presents. Commander Elwell-Sutton tries to give a generalized picture of China through the ages with a running interpretative

commentary on the succession of events, and it is clear that this is the result of much delving into material and of considerable reflection. In the main it is informed by sympathy and understanding, although the value of these qualities is sometimes marred by a rather irritating note of condescension and even of patronage, as for example when he tells the Chinese people that "they must do better than they have done." There is not a people in the world to whom that advice might not be tendered, but it is invidious to single out a people who have contributed so notably to the achievements of humanity and who at the present time are, naturally enough, peculiarly sensitive to criticism of this kind.

It must be said also that the author's analysis of China's problems and difficulties is distinctly one-sided. His interests are clearly in the ethical sphere, and his judgments on the comparative success or failure of China at various phases of her history and his estimates of her future are almost entirely relative to his view of the fundamental philosophies of "The Great Tao," of Confucianism and Buddhism, which he gives in the opening chapters of his book, and of their adequacy as mainsprings of action and conduct. It is of course most fitting that in a civilization where ethical considerations have counted for so much that particular attention should be directed to this aspect of the national life, and the lucid summary of the different schools of thought which have influenced China is one of the best features of the book. It may be granted too that the ethical orientation of a people is ultimately the most important factor in its destiny. But the author's bias on this side leads him to understate or ignore problems of a different character which vitally affect the future of China. Of the grinding mass-poverty and related evils which result from over-pressure of population he has almost nothing to say, nor of the modern movement towards rural reconstruction which is one of the most hopeful features of recent years. The geographical aspect of China's political problem is omitted altogether, as indeed it usually is in estimates of China's prospects. But it is, in any balanced view, fundamental. Can a continent be organized as a nation, and, if so, on what basis? The task of creating a single nation-state out of a composite civilization covering an area comparable to that of Europe and equally diversified, is hardly less stupendous, although admittedly less complex, than that of achieving an All-India Federation.

P. M. R.

AFRICA

GAMBIA AND BEYOND. By REX HARDINGE. *London: Blackie & Son* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 210 pages; illustrations and maps.* 10*s* 6*d*

Gambia is the oldest British settlement in Africa and dates from about 1618, when James I granted a Charter to some rich merchants of the City of London who founded Fort James on an island about 35 miles up the river. Since that date, though not perhaps quite continuously, Gambia has remained in British possession. At the present time it consists of the Colony and Protectorate, the former Bathurst Island at the mouth of the river, the latter a strip of country on either bank of from 10 to 20 miles in width extending inland some 300 or 400 miles.

In the present volume Mr. Hardinge gives us an account of his adventures during a visit of some months to West Africa. He started from Marseilles with a somewhat scanty equipment of outfit and cash and travelled third class to Dakar whence he made his way, partly by rail partly by motor, to the Gambian frontier. For some weeks he wandered about in the Protectorate and then struck south into Portuguese Guinea where, owing to a sudden illness which he at first believed to be dysentery, but afterwards put down to poison, he returned

through Gambia and Senegal to Dakar. The object of Mr. Hardinge's journey appears to have been experience, and he has written a vivid account of his adventures and impressions. He can hardly be described as a scientific traveller as he seems to have little knowledge of the animals and plants that he met with, nor can it be said that the country he marched through was in any way unknown; but his descriptions of his adventures make pleasant reading and give one a good idea of the country of Ground-nuts—the trade on which the prosperity of the French Colony of Senegal and the British Colony of Gambia is almost entirely dependent. W. L. S.

WESTERN CIVILISATION AND THE NATIVES OF SOUTH AFRICA: Studies in Culture Contact. Edited by J. SCHAPERA. *London: G. Routledge & Sons* 1934. $9\frac{1}{2} \times 6$ *inches;* xiv+312 *pages; illustrations and maps.* 15*s*

This volume contains twelve essays, two of them contributed by the Editor. Dr. Schapera is already well known as an anthropologist: his 'Khoisan Peoples of South Africa,' and various papers contributed to *Africa*, the *Journal of the African Society*, and *Bantu Studies* are sufficient evidence of his wide knowledge and power of clear presentation. The first of his two essays is an interesting and suggestive survey of "The Old Bantu Culture"—now, it would appear, rapidly disintegrating. Under the heading "Religion and Magic" occurs the very pertinent remark that "the belief in magic and witchcraft arises not from a specific type of inherited mentality, but from a particular form of cultural environment"; and it would seem as though every fresh addition to our knowledge of the more primitive peoples tended to rebut Professor Lévy-Bruhl's theory of a "pre-logical mentality." His account of "Present-Day Life in the Native Reserves" scarcely, on the face of it, encourages a hopeful outlook; but conditions in the BaKxatla Reserve (the area best known to Dr. Schapera, from which the main points of his picture are taken) would seem to be in some respects peculiarly unfavourable, apart from the dislocations necessarily involved in a period of transition. Dr. Eiselen, Lecturer in Bantu Studies at the University of Stellenbosch, writes on the religious life of the Bantu as affected by Christianity, and Mr. W. G. A. Mears, Head Master of Rondebosch High School, discusses the position of the educated native in Bantu communal life. The outlook here would seem to be distinctly encouraging. Professor Lestrade of Pretoria describes the changes effected in Bantu vernaculars by the impact of European languages, and the increasing use of English as an instrument of culture and a medium of advanced instruction, as well as of intercourse between mutually unintelligible tribes. That it will ever be adopted as "a real home-language" by the people, as it has been (with considerable modification) in the West Indies and in some parts of West Africa, is however unlikely. Two most important essays are those on the economic position of the rural natives and the urban natives respectively, contributed by Dr. H. M. Robertson and Mr. Rheinallt Jones. The paper following these, Professor Hutt on "The Economic Position of the Bantu in South Africa," does not quite cover the same ground and is a useful supplement to the other two, while containing, possibly, some debatable propositions. We may wonder, for instance, whether it is true that "the Bantu languages are unsuitable for use in the life of the modern world"; though this may be dismissed as a minor point, apart from the main scope of the essay. We are grateful for the clear and concise account of the working of the Natives' Land Act (1913), the Native Urban Areas Act, the Mines and Works (Amendment) Act ("Colour Bar Act"), the Native Service Contract Act of 1932, and the various Masters and Servants Acts. But one sentence on p. 237 seems unintelligible as it stands: "The present writer believes that the force of

competitive capitalism is too strong to enable the continued subjection of the Bantu."

Professor Brookes's admirable summary of the facts regarding Native Administration should send readers to his 'History of Native Policy' (1927) and other works. Incidentally it may be noticed that police methods are blamed, in almost identical terms, for native discontent by three different writers: Professor Brooks, Mr. Rheinallt Jones, and Professor Jabavu. The statement by the last named of "Bantu Grievances" is extremely forcible, but (as may be deduced from a comparison with the other papers) not a whit too strong. Professor Hoernle, on "Race-Mixture and Native Policy," disposes pretty conclusively of the current biological objections to unions between different races, while admitting that they are as a general rule undesirable, at any rate for the present, and having regard to the fact that the greater number of such unions have been irregular, involving serious injustice to the weaker party. He also stresses the point that, while segregation in the strictest sense is impracticable (a fact also demonstrated by Dr. Robertson), such segregation is by no means necessary for securing the desired end.

The book is a notable contribution to our knowledge of the subjects treated, and its value is enhanced by an excellent bibliography and two useful maps. The photographs are interesting, but one wishes that they could have been enlarged. A. W.

NORTH AMERICA

ECONOMIC HISTORY OF THE PEOPLE OF THE UNITED STATES.

By Fred Albert Shannon. *New York (and London): The Macmillan Company* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii+942 *pages; maps.* 16*s*

In view of the extent to which "the events of the past few years have tended to center the attention of the people of the United States upon general economic problems," the author considers it desirable, for an appreciation of the current problems of the United States, to give a history of economic development, world-wide in scope, since the commencement of the commercial revolution. In his own view the length of this volume, compared with other manuals, is due to the more than customary full treatment of "labor, the growth of monopolies, the tariff, agriculture and agrarian problems," but others may object that the inclusion of somewhat dogmatic and frequently biassed references to European, and especially English, Economic History increases the bulk, but not the value, of the book. Such statements as "In England quit-rents were a survival of the age when nobles furnished protection to peasants in return for such payments," or "The only reason why slavery did not flourish in Europe outside of the Iberian Peninsula was that labor of peasants and serfs was cheaper," are not calculated materially to assist the author in his attempt to present in one volume to the American student a comprehensive view of the economic past of his own country.

The aims, scope, and size of this book inevitably lead the author in his more detailed description of the last seven decades to a highly statistical account, presumably to obviate the alleged fallacy "that the activities of greater numbers of people necessarily require more words to describe." There are numerous tables incorporated in the text, and the removal of these and much other statistical information to an appendix would materially simplify the task of the reader. "Back of" the "horrendous" figures glorifying the American nation there is much useful information for the British student of present-day American economic problems. The treatment of the growth of transport is especially

noteworthy, and it is unfortunate that the unexpectedly human treatment of this subject could not, owing to the very limitations of travel, play an important rôle in the first part of the book, devoted to the Period of Colonial Dependence up to 1789. The remaining three parts, the Period of Dominant Sectionalism 1789–1865, the Rise of Capitalism 1865–1900, and the Capitalistic Age 1900–1933, however, all in different degrees gain in interest from the treatment of this theme. The account of the westward movement is somewhat disappointing, but on the other hand the treatment of agricultural problems is often of great interest—notably the chapter on the uncertainties of agriculture.

At the end of the text a critical bibliography is included. This is arranged according to topics and, although not claiming to be comprehensive, forms a valuable guide to further reading. F. R. G.

THE DIABOLIC ROOT: a Study of Peyotism, the New Indian Religion, among the Delawares. By VINCENZO PETRULLO. *Philadelphia: University of Pennsylvania Press* (*London: Humphrey Milford*) 1934. 9×5½ *inches;* x+186 *pages; illustrations.* 9*s*

The "Diabolic root" is Peyote, a species of cactus found in Northern Mexico and Southern Texas. It is a narcotic whose properties are as yet imperfectly known. Usually the first dose produces vomiting, sometimes severe; further doses bring exhilaration and visions. The ritual use of Peyote among American Indians is a modern development. This careful study of the Peyote cult among the Delawares of Oklahoma is an interesting addition to our knowledge of the spread of this ceremonial. The Winnebago Cult has been admirably recorded by Dr. Radin and discussed at some length by Professor Bartlett in 'Psychology and Primitive Culture.' In both cases the ritual varies in accordance with the character and social standing of the principal agents. The influence of pre-existing patterns of ritual and cultural activity produces compromises and combinations, though the selection of certain elements in these combinations is determined by individual and group features. In some cases stress seems to fall on the wickedness of the Whites who killed the child Jesus. In general the doctrines include purity of thought and act, altruism and humility, and faith. There are new cultural elements and there is a sense of conflict: Peyote gives peace. Old Delaware elements are maintained and the influence of Christianity is visible in the use of the crucifix. Indeed (p. 173) there has been a strong effort to reconcile Christianity with aboriginal ideas. There are diehards who cling to the ancient ways and there are those who seek to adapt their life to the advancing civilization. Peyotism seems easy to some—perhaps to many—for it claims to be a spirit force that brings enlightenment and peace and prepares the individual for the next life (p. 139). T. C. H.

CENTRAL AND SOUTH AMERICA

FLYING OVER SOUTH AMERICA: Twenty Thousand Miles by Air. By ANNIE S. PECK. *Boston and New York: Houghton Mifflin Company* 1932. 8½×5½ *inches;* xiv+256 *pages; illustrations and map.* $3.50

This entertaining and informative book is the record of a remarkable achievement, described, in the author's words, as "the story of a long flight by a woman in her eightieth year." Miss Peck, using the commercial air routes available in 1929 and 1930, travelled more than 20,000 miles by air over South America, from Barranquilla to Puerto Montt, thence over the Andes to Buenos Aires, and along the greater part of the east coast of the continent and across the Caribbean to Miami. Her record of this journey is unpretentiously written. The minor dis-

comforts of such travel were met in the right spirit, changes in familiar scenes enthusiastically welcomed, and opportunities to visit new scenes eagerly seized. When the plane in which she was flying from Victoria to Caravellas made a forced landing, she merely reflects thankfully that a kind American gentleman had bestowed upon her that morning five *Saturday Evening Posts*, and that she had with her a luncheon. This is also evidence of her ability to make casual friendships, a faculty which frequently stood her in good stead.

Her notes on the towns visited and country traversed will be of use to those following in her tracks, and a concluding chapter summarizes the advances since made in air communications, Buenos Aires now being reached in seven days from Panama. Among the interesting photographs are many taken by the author herself. The whole book is ample evidence that her physical and intellectual qualities are as vigorous and untiring as when, thirty years before, she covered some of the same ground on foot, climbing Huascaran and other great peaks of the Andes.

G. R. C.

POLAR REGIONS

GEOLOGICAL INVESTIGATIONS IN EAST GREENLAND. Part I. General Geology from Angmagsalik to Kap Dølton. By L. R. WAGER. (Meddelelser om Grønland, Bd. 105, Nr. 2.) *København: C. A. Reitzels Forlag* 1934. 11×7 *inches; 46 pages; illustrations and maps*

This is an important contribution to the geological survey of Greenland. Its well-known author, noted not only for his Arctic work but for his mountaineering on the last (1933) Mount Everest Expedition, has had exceptional opportunities to examine a stretch of the East Greenland coast which until recently had remained singularly unknown. As geologist to the late H. G. Watkins's British Arctic Air Route Expedition to East Greenland in 1930–31, in the course of summer boat journeys in the Angmagssalik[1] fjords and along the coast to Kangerdlugsuak, and in winter work in the Sermilik Fjord, as well as during the Ice-Cap journey to Mount Forel, important pioneer geological and geographical reconnaissances, together with some detailed investigations, were carried out by Mr. Wager.

In the summer of 1932 the author was invited by the Scoresby Sound Committee and Captain Ejnar Mikkelsen to join the latter's expedition to the Blosseville Coast and Kangerdlugsuak. He was thus enabled to continue his geological work already commenced at Kangerdlugsuak and to extend investigations northwards as far as Cape Dalton within about 70 miles of Scoresby Sound itself. With what enterprise and skill the work was carried out this report bears abundant evidence.

The report is essentially a geological one of the field studies made in this extremely difficult stretch of country, and it is to be followed later by detailed petrological descriptions of the various rock-types met with. Mr. Wager found that from Angmagssalik to Kangerdlugsuak the coastal strip is underlain predominantly by ortho-gneisses of the Metamorphic Complex, with restricted areas of schists and amphibolites, all probably of Archean age. Also ascribed to this age were interesting occurrences, in the interior at Mount Forel, and in restricted areas on the coast at Sermilik, Kangerdlugssuatsiak, and near Tugtilik (Lake Fjord), of the unusual rock-type charnockite, which occurs in peninsular India and a few other places only. The same type was found by the reviewer in 1931 in Mount Razorback in Northern Labrador, and it is of considerable

[1] This is the more usual spelling, with double *s*, which is in use on the maps accompanying the Report.

interest that this rock-type should apparently be confined without exception to pre-Cambrian terrains throughout the world. Certain granites and gabbros which occur on Angmagssalik Island and Fjord are tentatively considered by Mr. Wager to be of Caledonian age, although other clear evidence of that great mountain-building movement, which has notably affected North-East Greenland, is wanting on this particular stretch of the south-east coast-line. At Kangerdlugsuak was found a considerable development of plutonic rocks of Tertiary age, including an interesting group of nephaline syenites, but no minerals of economic importance, which might be expected to be associated with them, have so far been reported.

From Kangerdlugsuak to Cape Dalton on the Blosseville Coast, plateau basalts of Tertiary age are developed on a huge scale. These are likened by the author to the corresponding occurrence of these rocks in the north-western parts of the British Isles, where it is known that large areas have since foundered or otherwise been lost by the processes of denudation. In the broad peninsula between the southern branches of Scoresby Sound and Kangerdlugsuak, Mr. Wager estimates the thick series of basalt lavas, both exposed and beneath the ice-cap, to cover some 16,000 square miles. That the area so underlain was even greater is indicated by the small isolated patches as far south as Cape Gustav Holm. Another phase of Tertiary igneous action was the extensive injection of dolerite dykes, but in no case was it proved that such a basic dyke had acted as a feeder for a lava flow. The unquestionable lower age of these basalts and dolerites is shown by the associated occurrence of Tertiary fossiliferous sediments at Cape Dalton, Cape Gustav Holm, and elsewhere. Hot springs however still occur along the Blosseville Coast and in Scoresby Sound, and the author considers it possible that the igneous activity of East Greenland may have ceased more recently than the corresponding Tertiary eruptions of the British Isles.

This report being essentially a geological one, the development of the present land-forms of the region is not discussed. Mr. Wager has however elsewhere[1] shown that the direction of the coast from Kangerdlugsuak to Angmagssalik is controlled by the gentle inclination of a peneplane, which he believes extends underneath the inland ice-cap, and to have been upwarped to its elevated position in post-Eocene, and probably Miocene, time. Indeed he has argued that the present ice-cap may have come into existence upon this peneplane as early as the Miocene period, although the present writer has heard it claimed that there is fossil evidence in western Greenland to refute this hypothesis as to age. Be that as it may, the author clearly demonstrates that, consonant with this upwarping inland, which extends into the region north of Kangerdlugsuak, both the seaward dip of the lavas and the normal faulting at Cape Dalton indicate a gentle downwarping of the crust where Denmark Strait now lies, between the Blosseville Coast and Iceland. And the slope of the peneplane from which the present mountains have been cut, that in the vicinity of Mount Forel preserve such conspicuous relics of it, is apparently a continuation of this same movement.

The author has moreover shown that related to these bigger movements are two sets of faults dominating valley and fjord formation, and he has pointed out the association often of the larger fjords with the higher mountains. At Kangerdlugsuak and near Kialinek the higher mountains are connected with the greatest development of the Tertiary plutonic intrusions. It is to be hoped that during the author's next projected visit to this region ample opportunity will be afforded for the furtherance of the interesting geomorphological studies already commenced. The report is provided not only with a geological map in

[1] *Geogr. J.*, vol. 79, 1932, pp. 486–488; *Geol. Mag.*, vol. 70, 1933, pp. 145–156.

two sections covering the whole area examined, but with an excellent set of photographs (some taken from the air by the late "Gino" Watkins), which fully and clearly display the clean-cut exposures and structures that are such an aid to the geologist in the Arctic. Very few typographical errors are noted in the text.

In the Preface the author pays a graceful tribute not only to the Danish sponsors of that portion of his work carried out under their auspices, but in particular to Watkins, as one who, although untrained technically, "had a great gift for understanding in a general way the significance of the various scientific problems which he or others came up against," and "who contributed nothing but genuine help and encouragement." Watkins died in the very centre of the region under consideration, to our knowledge of which he made such a notable contribution. N. E. O.

NORWEGIAN NORTH POLAR EXPEDITION WITH THE *MAUD*, 1918–1925. Scientific Results. Vols. II and III. Meteorology. Part I. Discussion. Part II. Tables. By H. U. SVERDRUP. Published by Geofysisk Institutt, Bergen, in co-operation with other institutes. *Bergen* 1933. 12×9 *inches;* 331; 527 *pages; sketch-maps and diagrams. Kr.* 25 *each volume*

The *Maud* expedition was originally planned by Roald Amundsen to repeat Dr. Fridtjof Nansen's drift across the polar sea mainly for oceanographical research. Although the primary objective was frustrated by unfavourable ice conditions a large amount of valuable scientific work was carried out off the north coast of Siberia partly on drifting ice and partly in fixed positions near the coast. Dr. Sverdrup was in charge of this work assisted after 1922 by the late F. Malmgren.

The present discussion of the meteorological results makes an important contribution to Arctic climatology, whose value is enhanced by the attractive manner in which a good deal of rather abstruse subject-matter is handled. The scientific staff which was small and, in the absence of a regular crew, had perforce to perform sailors' duties, managed, in addition to ordinary standard observations, to make kite and balloon ascents, temperature observations at 30 metres, records of the difference of temperature between the surface of the snow and the air at a height of 80 cm., radiation measurements, and investigations of sea-ice, snow, and hoar-frost. The somewhat perplexing features exhibited by the diurnal variation of temperature and wind velocity in polar regions is discussed in the light of other expeditions both in the Arctic and Antarctic. The late Professor H. Mohn's deduction that there is an area around the North Pole with the mean July temperature a degree or two below the freezing-point is doubted. The new evidence points to the July temperature being a fraction of a degree above freezing as compared with a June temperature about 2° C. and an August 3° C. below.

At all seasons of the year there exists over the polar basin a large temperature inversion in the lowest 500 metres; that is to say the temperature is higher above than below that level. The inversion however is especially marked in the winter months, and in connection with this condition we find what are perhaps the most interesting and important results in the entire volume. These relate to the calculation of the greatest possible extremes of temperature over the pack-ice during the dark winter season, and their approximate verification from observation. In winter no heat is being received from the sun and there are no thermal disturbances due to melting snow and ice. Consequently the temperature over the surface of the snow represents a balance between the heat lost by outward radiation and the heat gained partly from below the snow and ice by conduction

and partly from wind which by its mixing effect draws down warmer overlying air or brings air from warmer regions. Thus wind in very cold weather always causes the temperature to rise, so that the extreme minima in the Arctic can only occur when the air is calm and the sky clear.

Investigation shows that loss of heat by radiation does not go on indefinitely, the rate slackening off, as the temperature sinks very low, to a limiting equilibrium value. This limit which can be reached when the condition of the snow is such that no heat is passing up through it represents the lowest possible temperature which can be produced by radiation. The calculated minimum is −75° C., and in verification it is pointed out that the lowest temperature ever recorded at the Earth's surface, namely −70° C. (−95° F.) at Verkhoyansk in north-east Siberia, is near this value. The lowest temperatures observed on the *Maud* expedition, which were higher than those recorded on the *Fram*, were −43·5° C. on the pack and −45·4° C. at Cape Chelyuskin, agreeing quite well with the calculated probable value for a limited period.

Similar attempts to calculate the highest possible temperature in winter over the Arctic pack-ice were more difficult because, whereas the extreme minimum is governed entirely by local conditions as explained, the extreme maximum depends on the heat transported to the snow surface from above, or from warmer latitudes, by wind. When data however are used for the greatest observed mean daily wind velocity, the upper temperature limit works out at −14° C. (+6° F.). Only on seven occasions was a higher temperature observed on the *Maud* expedition. These results exemplify the fact that some branches of meteorology have already been placed on a quantitative basis.

The volume is printed in very clear type, but is wanting in summaries which would have helped readers greatly. Moreover there is no index map of the route of the *Maud*. L. C. W. B.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

OBSERVATIONS DE L'INTENSITÉ DE LA PESANTEUR avec le nouveau modèle de Pendule Holweck-Lejay. By N. E. NÖRLUND and A. SCHNEIDER. *Copenhagen: Imprimerie Bianco Luno A/S* 1934. 11×9 *inches; 164 pages*

MESURES DE PESANTEUR EN EXTRÊME-ORIENT. By Father PIERRE LEJAY, S.J. *Shanghai: Observatoire de Zi Ka Wei* [1934]. 12½×9½ *inches; 14 pages*

Before considering the subject-matter of these publications a brief description of the construction and working of the Lejay pendulum may not perhaps come amiss. The writer was privileged to see the Lejay pendulum at work in the neighbourhood of Copenhagen and to compare the ease and simplicity of this modern instrument with the relative complication of a set of Sterneck half-second pendulums which were in use close by. For these facilities and for much helpful instruction he is indebted to the courtesy of Professor N. E. Nörlund, the Chief of the Danish Geodetic Institute.

The Lejay pendulum consists in its essentials of a flexible strip of elinvar, supporting at its upper end a mass or bob of quartz, the lower end being firmly fixed. The pendulum is free to oscillate in a fixed plane under the combined forces of gravity and the elasticity of the strip. These forces can best be visualized in their components by in the first place assuming that the mass m is negligible, in which case the elasticity of the strip fills the functions of a tuning-fork and gives an accurate measure of time; and in the second place assuming m to be

very large, in which case the time of swing is infinite and instability sets in. It is near this latter highly sensitive range that the apparatus is most efficient. By enclosing the whole in a low-pressure vacuum the oscillations retain a measurable amplitude for a period of several hours. The instruments now in use have an oscillation period of the order of five or six seconds of time. Very small variations of g have a comparatively large effect on the observed time of oscillation: so much so that accurate observations can be taken by timing the series of oscillations with a tenth-second-divided pocket chronometer. The advantages of such timing will be most apparent to those who have carried out gravity surveys encumbered with chronometers, wireless sets, and all the temper-shortening impedimenta necessary for rating the chronometer by rhythmic signals immediately before and immediately after each series of swings. In fact this freedom from wireless signals, whether rhythmics or "commercial morse" with its consequent rigidity of programme, constitutes one of the greatest assets of the new pendulum. The use of these pendulums constitutes a saving of about 60 per cent. of the time spent at a station under the previous conditions. The financial saving in conducting a campaign will be of an even larger order than this, owing to the simplification of transport and the reduction in the number of trained personnel required.

The two publications under review are in the main simple records of work done with the Lejay pendulum. That carried out by the inventor himself includes gravimetric stations in the Philippines and the Dutch East Indies. Diagrams showing graphically the probable lines of isanomalies (Bouguer) are given of the islands of Bali and Java, and also of Cambodia and Cochin China. The results are clearly tabulated; the comparisons carried out on nearby stations with the results obtained by Dr. Vening Meinesz are of extreme interest. Photographs show the author under conditions of gravimetric survey which make us wish for further details of the method of transporting the instruments through jungle country, of the extent to which native labour could be utilized, and of the general practical conditions of the work. One illustration alone showing the suspension of the pendulum box by cords, perhaps elastic, in the back of a motor vehicle brings a blush to the cheek of the reviewer who failed to take similar precautions in the less backward but more dangerous regions of London S.E., with disastrous results.

Had there been any doubts as to the efficiency of these instruments; had any been inclined to think that, in common with many other inventions, they would give better results in the hands of their makers than when used by others, they are rapidly dispelled by a consideration of the book produced by Professor Nörlund and Mr. Schneider. The following quotation from the introduction serves to give an insight into the careful and concentrated investigation which has been carried out with, and into, the new Lejay pendulums. "In Denmark 30 field stations have been observed and in Copenhagen 273 measurements have been made with pendulum 31; 852 with pendulum 41; and 876 with pendulum 51. These latter fulfil the dual object of determining the constants of the pendulum and of discovering the constancy of the period of oscillation over a definite epoch."

A study of these publications serves but to confirm the conviction that the Lejay pendulum has come, not only to stay, but also to oust previous methods of gravimetric determination. J. C. T. W.

GEOMORPHOLOGIE. By FRITZ MACHATSCHEK. Second Edition. *Leipzig:* B. G. TEUBNER 1934. 9×6 *inches; 154 pages; illustrations and maps.* *M.*4.50

This is a well-produced book, but its scope and standard are rather limited. It

is quite impossible to do more than indicate the scope of geomorphology in 154 pages. This criticism is valid of most sections of the book. The author indicates the more important facts and processes involved in the subject, but his discussions are rather inadequate. As the book is intended for students of geography, it seems to the reviewer that much fuller accounts should have been given. On the other hand, it is just the type of book which would serve as an excellent "revision" book for a student who had attended a course in physiography and who wanted to see the whole subject set out in clear form, but in a limited space.

In dealing with coral reefs, for example, the author mentions the views of Darwin, Agassiz, Daly, and W. M. Davis; but, even if it be admitted that W. M. Davis's monumental work, 'The Coral Reef Problem,' errs on the long side, the reader, or student, can hardly be expected to find satisfaction in the five pages of the present volume, which include some pictures and a comprehensive bibliography as well. Much the same may be said of the chapter on coasts. Wave action and tidal action are not sufficiently discussed, and in the section on classification emphasis seems to be directed rather to empiricism than to a full account of, say, D. W. Johnson's views based on genetic principles.

It is fully admitted that the author has summed up his material well and clearly. The figures and pictures are good and quite well chosen. But the book is not full enough for the advanced student, and seems rather too compressed for the beginner. J. A. S.

ECONOMIC AND HISTORICAL GEOGRAPHY

COAL AND MEN: an Economic and Social Study of the British and American Coalfields. By HAROLD M. WATKINS. *London: George Allen and Unwin* 1934. 9 × 5½ *inches; 460 pages; illustrations.* 18*s*

This work, although it will appeal more to the economist, is certainly not without interest to the geographer. Its author, a lecturer on Economics under the Glamorgan County Council, had made himself cognizant of mining conditions not only in South Wales but in other British coalfields when in 1928 he was awarded a Research Fellowship of the Rockefeller Foundation in order to make a comparison of the economic conditions existing in South Wales and in one or more American coalfields. The present book, which embodies in an extended form the result of his research, is comprehensive and well informed; it includes chapters not only on the geographical distribution of coal in the two countries and on the physical conditions under which it is mined in each, but on wages, hours of labour, organization of employers and employed, housing conditions, and the influence of environment on the life of the miner. These various subjects are often more closely connected than might at first sight appear. For example, the average depth of the workings in Great Britain is just over 1000 feet, while in the anthracite mines of the United States it is 415 feet, and in the bituminous 262 feet. Accordingly, in Great Britain where the cost of sinking a shaft is high the practice is to work all the coal which can be reached by it, whereas in the United States where most of the seams exploited at present lie near the surface, the mines are more quickly exhausted and are replaced by new ones. One result is that on some of the coalfields at least housing conditions are much worse than in Great Britain. The same lack of permanence in the mining settlement has also tended to make more difficult the organization of the workers, though here perhaps the intermixture of races on the coalfields and the fact that in the south many of the miners are negroes have been more important factors. A chapter on physical and social environment, consisting

mainly of extracts from essays written by the author's pupils and from his own American diary, provide some raw material for the student of social geography.

Mr. Watkins does not conceal the fact that his sympathies are with the miner, but he writes with knowledge and judgment, and his book is to be recommended. One of his conclusions should prove of special interest to people in this country. "In the matter of welfare schemes," he says, "particularly those catering for the recreational, health, and educational needs of the miners, Great Britain is far ahead. . . . Such schemes have done far more to mitigate some of the more ugly features of the colliery districts, and to brighten the lives of the miners of Great Britain, than has been effected by schemes for the improvement of American mining communities." J. McF.

GENERAL

THE STUDY OF LOCAL GEOGRAPHY: a Handbook for Teachers. By C. A. SIMPSON. *London: Methuen & Co.* 1934. $8\frac{1}{2} \times 6\frac{1}{2}$ *inches;* viii+68 *pages; maps.* 3*s* 6*d*

According to the publishers' announcement, this book is written for teachers, club leaders, and others who wish to interest young people in intelligent "exploration" and "survey making" in the Home District. Every geographer will wish Miss Simpson the fullest measure of success in her endeavours to use geography to arouse the interest of the rising generation in the innumerable problems of their homeland and so to produce a nation of intelligent, well-informed, and thoughtful citizens, whether through her writings or through her field classes at Cranham. The suggestions in this little book, with its thirty exercises, cover a wide field; the chief criticism must be that the instructions might have been much fuller and more explicit. The majority of teachers can scarcely have enjoyed a full training in all the subjects they are required to teach; regional survey is entirely new to many and they need to be told exactly what to do and how to do it. Much training is needed before children realize what is meant by "regions of distinctive vegetation" which are to be marked on a map (p. 34). The study of local geography is outdoor work, too much time is often wasted in tracing details from published maps—as boring and as unrelated to the work of observation as the old subject of "map-drawing"—and for this reason the five maps would have been better omitted. Perhaps the publishers are to blame for the absence of examples of maps illustrating those fine original school surveys initiated by the author herself in Oxfordshire or of the many others quoted in the text. L. D. S.

MAURICE DE BUNSEN: Diplomat and Friend. By EDGAR T. S. DUGDALE. *London: John Murray* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii+358 *pages; illustrations.* 15*s*

In the title of this life of Sir Maurice de Bunsen, formerly Foreign Secretary of the Geographical Society, and at the close of his diplomatic career H.M. Ambassador at Vienna at the outbreak of the Great War, he is most justly described as "Diplomat and Friend." The book well discloses the secret of his extraordinarily successful diplomatic career, which lay, apart from his great natural abilities, in his power of making friends wherever he went. No country was too small, no question too insignificant for him to give to it his whole attention and his sympathetic consideration. Coming on his father's side from a German family (his grandfather, Baron Christian C. J. de Bunsen, was Prussian Minister to the Swiss Republic and afterwards to the Vatican); and on his mother's, who was a Gurney of Ham House, West Ham, Essex, English of the English, he seems to have inherited the best qualities of the two races. From

Germany he got, no doubt, his capacity for work and grasp of detail, from England his power of making friends with all and sundry and his elasticity of mind in political matters. He was, above all, in affairs no pedant. In one of his speeches in South America delivered in Spanish, which he spoke as he did German and French quite fluently, he quoted some old Venetian diplomat to the effect that diplomacy is "*la ciencia de las personas*"—the science of men. Maurice de Bunsen made that science his special study so well that wherever he went he served his country, to which he was wholly devoted, with conspicuous success.

Perhaps the best tribute to his great gifts as a diplomat as well as the best confirmation of what has been said above respecting his thorough interest in and knowledge of the countries where he was stationed, however distant and however, to the outsider, possibly lacking in vital interest, is to be found in the really touching letter written to him by King Chulalongkorn of Siam when he was about to leave that country in 1896. The king having heard he was shortly to be transferred to Washington, wrote:

> "I hardly know what to say. With you here the British Government and ours have worked admirably together; with you our difficulties seem to be lighter, and besides you are one of the few Europeans with whom we feel at home together—and I had hoped you might remain longer. Your departure will be a real loss to us.
>
> "My perfect confidence in you I hope you will believe and on account of all this that I greatly regret the loss of you."

There we find in a few words the secret of his success. "You are one of the few Europeans with whom we feel at home together." It was the same wherever he went, from his first post to his last: from the United States in 1878 as Attaché through Spain, Japan, Siam, Turkey, Portugal, Spain again where as Ambassador he was present at the marriage of King Alfonso and Queen Victoria Eugenie, and helped the Queen out of her carriage after the terrible bomb outrage on her wedding-day, on to Austria. The fateful weeks, days, and hours that preceded the great catastrophe in July 1914 are graphically described in this book. Vienna was his last real post as Ambassador, though after the War he was sent as special Ambassador on a Goodwill tour to all South American countries, a tour which, by all accounts, was eminently successful.

The story of the varied career connected with such events is an extremely interesting one and will make many who hardly realize what work he did for his country understand what a great public servant he was. It is perhaps invidious to make any criticism of a book of this sort, but it is difficult to avoid feeling as one reads it that some of those pages devoted to bald statements of visits to country houses in England, with accounts of shooting parties, etc., while they help to give the reader an idea of the all-round man Maurice de Bunsen was, might have been curtailed in favour of a fuller account of the political conditions obtaining in every country where he served, which would have helped those unacquainted with the political and diplomatic history of the times to understand his work better. There is a delightful description very true to life (p. 305) of de Bunsen by Mr. Percy Lubbock written during the winter of 1912–14 when he was Ambassador in Vienna.

Maurice de Bunsen married in 1899 Miss Lowry-Corry who proved as perfect an Ambassadress as he was Ambassador; there are some who affirm that a good Ambassadress accounts for seventy-five per cent. of the success of a successful Embassy, but of the de Bunsens it may fairly be said that the honours were divided. The book is an eminently readable one and contains some new items of information regarding not only the negotiations between France and Spain for the partition of Morocco into zones of influence between those two

countries, in which negotiations de Bunsen acted successfully as the honest broker and helped to avoid serious complications, but also regarding the attitude of the various characters on the political stage at Vienna immediately preceding the War. H. of P.

NINE AGAINST THE UNKNOWN: a Record of Geographical Exploration. By J. LESLIE MITCHELL and LEWIS GRASSIC GIBBON. *London: Jarrolds* 1934. $9\frac{1}{2} \times 6$ *inches; 320 pages; maps and portraits.* 18*s*

The guiding principle in the selection of these nine explorers appears to have been the interest of their personal characters rather than the value of their work. With one exception they are, as the publishers proclaim, "of the pre-scientific age" (the exception, though the authors would deny it, is Nansen), and have been chosen to represent the "irrational element" in exploration—"the quest for a land of geographical fantasy, a land of Youth and Fortune and Gold." This land of youth, as appears later, "betook itself to strange shapes . . . to the likeness of a mental refuge from a half-integrated self . . ." Inclusion in the list, therefore, depends ultimately upon the authors' interpretation of objective or character. Columbus and Cabeza de Vaca appear plausibly enough, but it is upon an interpretation of psychology, about which opinion must differ, that Nansen accompanies them. As representative of African exploration, Burton is preferred to Livingstone, for the latter "was a missionary-reformer-zealot led into exploration for the strangest variety of reasons, but never for that essential that we glimpse as the earth-conqueror's supreme compulsion." It would however unduly swell a brief notice to criticize the selection further, to suggest exclusions or additions. The ranks of explorers in all ages have harboured men of widely differing character and motives. Whatever the reason for their inclusion, these nine will always demand attention, and what is to be read of them here will at least interest the reader if it does not convince him.

Until fresh evidence is brought to light Columbus will remain an enigma, and biographers may weave as many facts as possible into a consistent whole, so long as they recognize that they are leaving many problems unsolved. Though some of Messrs. Mitchell and Gibbon's theories are open to challenge there may be something to be said for their portrait of him as "the devout and scoundrelly poet," but the difficulty, as they seem to recognize, is to reconcile it with "the explorer whose horizons the undiscovered West so vexed." Marco Polo, except perhaps that he set out to find the Great Khan, hardly represents an "irrational element." It is difficult to reconcile the account of his travels to Ormuz with the indifferent sketch-map, or with the findings of modern scholars. The study of Bering, less well known than the others, is vigorously written, though it may be questioned whether his objective owed anything to legendary ideals. Burton offers scope to the authors' fondness for psychological interpretation, but their sketch of his life is incomplete. Nansen should not have been included in this book. It is impossible to fit his career to the formula which the authors have evolved. He cannot be regarded as among the ranks of "irrational" explorers: his place, and that of the great polar explorers who have followed him, is surely among the pioneers of scientific exploration. But whatever their views on this point may be, a true picture of his career cannot be given by emphasizing his early work in Greenland, and dismissing in a most casual manner his later services to his country and the world.

The authors have striven throughout to attract and hold attention by a vivid and forceful prose style, which occasionally echoes Carlyle's. An awkward phrase, an obvious straining after effect, a strange liking for the prefix "un," at times disturb the reader, but on the whole they achieve their aim. A little more care might well have been expended upon the sketch-maps. G. R. C.

THE MONTHLY RECORD

A GIFT TO THE LIBRARY

The late Mr. Henry Yates Thompson was a generous benefactor of the Society's Library, to which he gave many volumes of rare early printed books and atlases. Since his death Mrs. Yates Thompson has, as recorded in the *Journal* for May 1931, presented five more atlases of high importance, in memory of her husband. She has now increased the indebtedness of the Society to her by presenting a case to display these fine books. The case, a handsome piece in English walnut to match the fittings of the Library, over 13 feet in length, has five compartments on either side, each capable of showing all but the tallest folios to the best advantage. It has been placed at the east end of the New Library, close to the cases containing the early printed books. A representative selection of the rarer gifts from Mr. Yates Thompson's library is now being displayed. They include the Rome Ptolemy of 1490, Berlinghieri's metrical Ptolemy printed at Florence *circa* 1480, and atlases by Mercator, Ortelius, Saxton, and Barlaeus. Two volumes are also shown for the interest of their bindings: a late fifteenth-century Gothic binding of stamped leather on boards, and an early sixteenth-century binding by John Reynes, binder to Henry VIII.

A NEW MAP OF SOUTHERN PERU

The Society has received from the Peruvian Corporation a number of copies of their "Industrial and Archaeological Map of Southern Peru": they are intended for free distribution to travellers interested in this region, and may be obtained while the stock lasts from the Map Room.

This map is a copy of a part of the 1931 edition of T. A. Corry's "Ferrocarriles del Sur, Mapa del Sur del Perú y parte de Bolivia," with rivers printed in blue instead of black and with the addition of the sites of Inca ruins overprinted in red. The Society already has a blue print of an earlier edition (1915) of Corry's map, and on comparing the 1931 edition with it, it is clear, allowing for the rather rough drawing, that the corrections and modifications to rivers and contours have been made from the American 1/M map, but that he has sometimes stuck to his 1915 contours. On the other hand, the American map, La Paz sheet, published in 1927, has taken many of the altitude figures from Corry's 1915 map and some of the contours may quite well have been based on his form lines. In one or two cases the American figures differ slightly from Corry, which suggests mistakes in copying. An obvious error is the figure for the height of Sicuani on the railway: Corry's (1915) figure is 3554 metres, but the river line which comes between the two 5's makes it look like 35154, and the American map gives the figure as 3515. Other examples are Checacupe 3428 (Corry) 3438 (American map), and Tirapata 3880 (Corry) 3860 (American map). All these places are on the railway. Corry's 1931 map leaves out many altitude figures and others have been corrected. In a few places small lakes have been printed in black so that they look like contours.

ASIATIC IMMIGRATION INTO AUSTRALIA

By a coincidence we have received for notice two recent German studies of immigration and settlement in Australia. The history of Asiatic immigration is summarized and the future of the "White Australia" policy discussed by H. Schneider in No. 6 of the *Dresdner Geographische Studien*. From the figures he has compiled from official sources it appears that previous to 1901 about 100,000 Chinese had entered the country, the peak year being 1888, after which

the annual figures decline rapidly. The number of Kanaka contract labourers imported was about 58,000, but by 1906 they had been repatriated. The temporary character of this immigration is also shown by the fact that the total number of non-Europeans at the 1921 census was approximately 31,000, a decrease of 7,000 on the previous census figures. Of these, 17,000 were Chinese. It is noteworthy that of the total 18 per cent. were Australian born, and that 85 per cent. of those with Chinese-born fathers had Australian-born mothers. The time when all will be born in the country appears to be drawing near. Persons of mixed race numbered about 18,000.

The author strongly defends the "White Australia" policy upon several grounds. The majority of the Asiatic immigrants were not true settlers, and tended upon the whole to gather in the towns. A further influx would not necessarily increase the number of agricultural workers. He also holds that the restriction of entry has not proved a handicap to the Queensland sugar industry, and quotes authorities to show that white colonization in the tropics has to overcome disease rather than climate, and that the final solution would be made more difficult by the presence of a large coloured population. Australia's economic position in the world would not be improved if she became to any extent a "plantation" for primary materials for an East Asiatic nation. He also summarizes the more familiar arguments for maintaining the high standard of living, for preserving a potential outlet for white colonization, and for avoiding an admixture of races in the interests of world peace. It will be seen that Herr Schneider does not shirk the expression of strong views.

A rather less optimistic picture of white colonization in tropical Australia is given in an article in the *Koloniale Rundschau* (Hf. 8–10, 1933), by Dr. W. Carius, from whom we have received a reprint. The author summarizes the available information, mainly from Australian medical papers, on the mortality and health of the population of Queensland, and concludes that the proportion of the population actually living in the tropics is too small, and the length of time elapsed is too short, for confident generalizations to be drawn. The incidence of diseases such as malaria is likely to increase should the population grow at a much greater rate. Immigrants from Southern Europe have become acclimatized more readily than others.

WORLD CHANGES OF CLIMATE

Dr. G. C. Simpson, in a lengthy paper entitled "World Climate during the Quaternary Period" published in the *Quarterly Journal of the Royal Meteorological Society* for October 1934, explains the succession of glacial and interglacial periods which are believed to have characterized the Pleistocene by a cycle of variation in the sun's radiation. The theory is that an advance of the ice-sheets can be brought about not only by a decrease in the general temperature of the Earth's surface but also, paradoxically, by an increase of temperature associated with heavier snowfall. Thus if the solar radiation were to increase from its present value there would be a general rise of temperature and an increase in winds, cloud, and precipitation. At first the increased precipitation would result in greater accumulation of snow in cold regions and the increased cloud would prevent summer melting. The polar ice-caps and the ice-fields on mountains would extend, spreading into lower latitudes and to lower heights. The steady increase of temperature however would soon prevent further advance of the ice and finally lead to melting of the ice. But a subsequent reduction of solar radiation would reverse the sequence: appearance and advance of ice, then a retreat due to decreased snowfall, and so back to present conditions with relatively small ice-fields both at the poles and on the mountains. Such an oscillation of

solar radiation would give rise in high latitudes to two glacial epochs and to two interglacial epochs one of which would be warm and wet, the other cold and dry; while in low latitudes there would be a single pluvial period having a maximum synchronizing with the maximum of the solar radiation and with the warm and wet interglacial. Two such cycles of solar radiation should on this theory have occurred during the Pleistocene: the first giving rise to the Günz glacial epoch, the Günz-Mindel interglacial which was warm and wet, the Mindel glacial, and the Mindel-Riss interglacial which was cold and dry; the following cycle giving rise to the Riss glacial, the warm, wet Riss-Würm interglacial, the Würm glacial, and finally the present cold, dry interglacial.

A difficulty in this theory which does not seem to have been pointed out is that it does not make clear the course of events along the ice-margin at the several stages described: especially why this should advance, instead of retreat, with rising temperature. Heavier precipitation accompanying increase of world temperature would certainly tend to make *rain* fall nearer the poles and higher up the mountains; but this point would perhaps be met by the argument that the heavier snowfall in the cold regions would have to find an outlet, and that the ice margin would preserve itself and even advance, because ice and snow surfaces chill the atmosphere around and are effective producers of cold by radiation.

From his previous researches into terrestrial radiation and the radiation balance of the atmosphere Dr. Simpson infers that at the maximum solar radiation the cloud amount was increased from the present ratio 0·5 to between 0·7 and 0·8 corresponding to the increase of temperature between 5° and 10° C. estimated from the geological record. He represents the sun as variable with an amplitude of 20 per cent. above and below its mean brightness. Some emphasis is laid in the paper on the importance of local geographical factors in determining the extent and distribution of glaciation as explained by Brooks and others. The ice extended much farther south in the Atlantic region than in the Pacific. It is shown how easily the British Isles could be re-glaciated with a turn, so to speak, of the prevailing winds and currents. Thus if the mean annual temperature of the sea-water round the British Isles were to drop from near 50° F. as at present to near freezing-point there could be no sustained summer warmth, snow would fall at times at midsummer even at sea-level, and heavy accumulations of snow and ice would soon appear in the mountains.

Among those who took part in the discussion of Dr. Simpson's paper were a number of prominent geologists. Whilst recognizing the importance of this attempt to clarify the picture of past climates and to bring the conception of Ice Ages more into line with present climatic experiences, they did not give unqualified assent to all the implications of the theory. In particular they questioned whether there is sufficient evidence for a general Pluvial epoch in North Africa at the time of the Ice Age in Europe.

FURTHER DETAILS ABOUT THE SIBERIAN METEOR, 30 JUNE 1908

A note which appeared in this *Journal* (vol. 73, 1929, p. 296) on Dr. L. Kulik's preliminary account of the great Siberian meteor in *Petermanns Mitteilungen* was followed by another note in the *Journal* (vol. 76, 1930, p. 176) referring to Dr. F. J. W. Whipple's description of the distant repercussions of the disturbance contributed to the *Quarterly Journal of the Royal Meteorological Society*. Subsequently Dr. L. J. Spencer referred to the event in his article on "Meteorite Craters as Topographical Features of the Earth's Crust" (*Geogr. J.*, vol. 81, 1933, p. 234). The current issue of the *Q.J.R. Meteor. Soc.* for October 1934 contains a further paper by Dr. Whipple "On Phenomena Related to the Great Siberian

Meteor," together with another by I. S. Astapowitsch, entitled "Air Waves Caused by the Fall of the Meteorite on 30 June 1908, in Central Siberia."

The radiant of the meteor lay in the constellation Cetus to the south of the ecliptic. The fireball followed a sloping trajectory from S.S.W. to N.N.E. at a speed of 50 to 100 km./sec., and after a path through the atmosphere about 500 km. long ended in a powerful explosion with the conversion of its kinetic energy into heat. Astapowitsch, who has gained first-hand information from the site of the impact in lat. 57° 41′ N., long. 108° 07′ E., describes the explosion as taking the form of a vertical column of fire with a blue aureole, observed at points up to 450 km. distant, and notes that its mechanical effects were felt by three Tungu families at a place 65 km. away. He states that the coniferous forest was uprooted and burnt for a radius of 10 to 15 km. by the action of the hot explosive waves and that trees were felled by the air-wave over a radius of 20 km., on high ground even up to a distance of 40 to 50 km. Kulik, who made later expeditions to the scene in 1929 and 1930, has examined the craters and made several excavations without finding any meteoric material. Hence Dr. Whipple points out that his former statement "clearly each of these funnels contains a meteorite" is proved wrong and concludes that the meteorites which formed the craters were entirely volatilized or else reduced to mere dust. Analysis of the microbarograms which were affected as far away as England, the United States, the East Indies, and Germany (by way of the antipodes) indicates that the impact of the body with the Earth occurred in the middle of the night of June 29–30 at 0h. 16m., G.M.T., corresponding to about 8 a.m. local Siberian time, though according to seismological evidence it occurred two minutes earlier.

Dr. Whipple considers that on this date there was an easterly current of air over Siberia and Northern Europe at a height of 80 km. with a speed of 200 km./hr., which carried the meteoric dust to North-Western Europe within twenty-four hours, causing abnormal sunsets, and intensification of midsummer twilight throughout the night of June 30 and July 1 and 2. It is confirmed that the limits of these remarkable optical effects were rather narrow, since nothing unusual about the sky was observed either in Southern Europe or North America.

These papers would seem to complete our knowledge of the main features of what is regarded as one of the greatest meteoric disturbances ever known to have affected this planet.

OCEANOGRAPHY OF THE ARCTIC OCEAN

In a reprint from the *Journal of the Czechoslovak Geographical Society*, entitled 'A Contribution to the Oceanography of the European Arctic Ocean' (Praha 1934), Dr. Josef Zukriegel gives the results of observations of surface temperature which he made while on a voyage in the S.S. *General von Steuben* from Bremen to Iceland, Spitzbergen, and the North Cape of Norway in July and August 1933. The method is not stated in the English summary, but a bucket appears to have been used. The general conclusion is reached that the temperatures were much above the normal for the season, and that there were many irregularities. The author recognizes that the latter may have been due to currents, but he would have done well to apply this explanation more widely. For instance, he attributes a fall of 4° C. in the surface temperature between Grimsey I. and the North Cape of Iceland to the presence of a berg, and adds that its effect on the surface temperature could be traced for more than 30 sea miles, and that the fog which it caused spread for more than 85 miles. The volume of this berg, of which a photograph is given, was estimated at 400,000 cubic metres: insufficient, if melted, to cover a square 650 metres on the side to a depth of 1 metre. When it is remembered in addition that a berg melts slowly so that part at least of the

thaw-water can be warmed by the sun it will be seen that it is quite unable to produce such an effect. It has often been shown in the past, for instance by the North Atlantic Ice Patrol, that the influence of a berg extends to a very small distance. D. J. [illegible]

OBITUARY

FRANK RICHARDSON CANA

Mr. F. R. Cana, who died on January 9th, had been a Fellow of the Society for thirty-four years. A journalist by profession—for the last eighteen years he was in the foreign department of *The Times*—his interests were very largely geographical. Though he made a special study of African affairs, his knowledge of recent exploration and development was by no means confined to that continent. The book by which he will perhaps be best known is his "South Africa from the Great Trek to the Union," published in 1909. He also contributed largely to the geographical sections of the 11th edition of the *Encyclopædia Britannica* and, on the African campaigns, to "The *Times* History of the War." Two papers of his which were published in this *Journal* dealt with the exploration of Africa and the opening-up of the Sahara. He was also for many years a reviewer of African books for the *Journal*.

Mr. Cana joined in 1906 the Kosmos Club, a dining club associated with the Society, serving as president during the years 1929–31. He was most popular with his fellow-members for his unfailing kindliness, humour, and breadth of interests.

MEETINGS: SESSION 1934–35

Fourth Evening Meeting, 7 January 1935. The President in the Chair

Elections: Mrs. Michael Andrews; Enoch William Archer; Roland St. John Braddell; George Walter Bullock; Satya Charan Chatterji; Godfrey Ernest John Foster, M.A.; Hugh Gray; Charles Clifford Hart, B.SC.; Homer John Herring; Miss Alison Hooper; Lieutenant Owen Cathcart-Jones, R.N.; Frederick Ernest Kemp; Miss Louisa Martha Mead; Rupert Norton Harding Newman, R.T.C.; James Garfield North; Christopher Pilkington; Norman John Greville Pounds, B.A.; Prof. Frederick Anselm Redmond; The Reverend William Hamilton Rogers; Mrs. Horatio Sandford; Dr. Hugh Scott, F.L.S., F.R.H.S.; Clarence W. Sorensen

Paper: Teleki's Volcano. By Mr. A. M. Champion

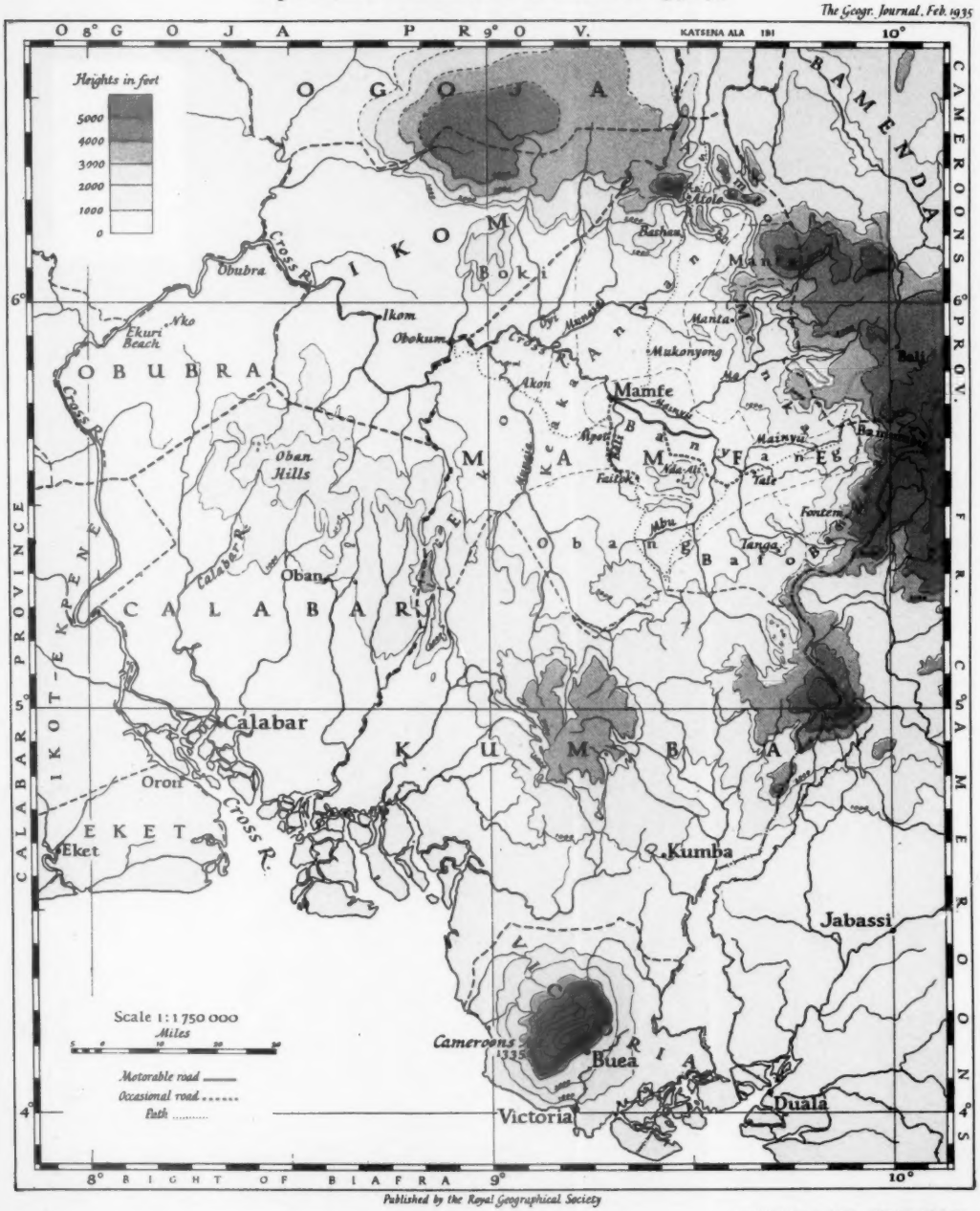
Third Afternoon Meeting, 14 January 1935. The President in the Chair

Paper: The Domesday Geography of Norfolk and Suffolk. By Dr. H. C. Darby

NIGERIA

Map to illustrate Mr. I.T. Sanderson's paper on an expedition to Cameroons Province in 1932-33

The Geogr. Journal, Feb. 1935



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CAMEROONS PROVINCE
Sanderson